TDM-20-N

1.0 GENERAL . . . . . 1 - 1
1.0.1 Benefon Forte and Data Interface . . . . . 1 - 1
1.0.2 Benefon Forte and Fax . . . . . 1 - 2
1.0.3 Benefon Forte and PC . . . . . 1 - 3

2.0 INSTALLATION INSTRUCTIONS . . . . . 2 - 1
2.0.1 Techninal Data of Benefon Forte . . . . . 2 - 3
2.0.2 Car Installation kit . . . . . 2 - 3
2.0.3 Transceiver Unit Installation . . . . . 2 - 3
2.0.4 Handset Installation . . . . . 2 - 5
2.0.5 Speaker Installation . . . . . 2 - 6
2.0.6 Microphone Installation . . . . . 2 - 6
2.0.7 Voice-Controlled HF Installation . . . . . 2 - 7
2.0.8 Mounting the Cables . . . . . 2 - 7
2.0.9 Antenna Installation . . . . . 2 - 9
2.0.10 Connections . . . . . 2 - 10
2.0.11 Identity Programming . . . . . 2 - 11
2.0.12 Combination Lock Programming . . . . . 2 - 11
2.0.13 Test Local Commands . . . . . 2 - 12

3.0 OWNER'S MANUAL . . . . . 3 - 1

4.0 LOCAL SERVICE COMMANDS . . . . . 4 - 1
4.0.1 General . . . . . 4 - 1
4.0.2 Special Push Buttons In Local . . . . . 4 - 1
4.0.3 General Form Of Commands . . . . . 4 - 1
4.0.4 Local Commands . . . . . 4 - 2
4.0.5 Guide Texts And Error Situations . . . . . 4 - 11
4.0.6 Local-Box . . . . . 4 - 12

5.0 TUNING INSTRUCTIONS . . . . . 5 - 1
5.0.1 Connect To Phone . . . . . 5 - 1
5.0.2 Synthesizer . . . . . 5 - 1
5.0.3 RX-VCO . . . . . 5 - 1

5.0.4 TX-VCO . . . . . 5 - 1
5.0.5 Channel Frequency Adjustment . . . . . 5 - 2
5.0.6 Transmitter . . . . . 5 - 2
5.0.7 TX-Audio . . . . . 5 - 2
5.0.8 Max DEV . . . . . 5 - 3
5.0.9 FFSKT . . . . . 5 - 3
5.0.10 RX-Audio . . . . . 5 - 3
5.0.11 RX-Response . . . . . 5 - 3
5.0.12 RX-Distortion . . . . . 5 - 3
5.0.13 TX-Distortion . . . . . 5 - 4
5.0.14 FII DEV . . . . . 5 - 4
5.0.15 Tuning The RSSI-Levels . . . . . 5 - 4
5.0.16 Tuning FSK-split level . . . . . 5 - 5
5.0.17 Program Base-Band (if neccessery) . . . . . 5 - 5
5.0.18 Programming The Subscriber Number . . . . . 5 - 5

6.0 TRANSMITTER MODULE OT0001 SPECIFICATIONS: 6 - 1

6.0.1 Connector Description: . . . . . 6 - 1
6.0.2 Tuning Instructions: . . . . . 6 - 1
6.0.3 Test Point Voltages . . . . . 6 - 2
6.0.4 Parts list . . . . . 6 - 4

7.0 RECEIVER MODULE OR0002 SPECIFICATIONS . . 7 - 1

7.0.1 Principles Of Receiver Operation . . . . . 7 - 1
7.1 Receiver OR0002 settings . . . . . 7 - 2
7.1.1 Supply Voltages . . . . . 7 - 2
7.1.2 Setting Order: . . . . . 7 - 2
7.1.3 Check Sensitivities . . . . . 7 - 3
7.1.4 Parts list . . . . . 7 - 4

8.0 SYNTHESIZER MODULE OS0021 SPECIFICATIONS 8 - 1

8.0.1 Functions . . . . . 8 - 1
8.0.2 Circuit Description . . . . . 8 - 1
8.0.3 RX-Synthesizer . . . . . 8 - 1
8.0.4 TX-Synthesizer . . . . . 8 - 2
8.1 Synthesizer OS0021 Settings . . . . . 8 - 3

8.1.1 Checking Operating Voltages . . . . . 8 - 3
8.1.2 RX-VCO Adjustment . . . . . 8 - 3
8.1.3 TX-VCO Adjustment . . . . . 8 - 3
8.1.4 Setting Channel Frequency: . . . . . 8 - 4
8.1.5 Adjusting The Modulation: . . . . . 8 - 4
8.1.6 Correcting The Low-frequency Response: . . . . . 8 - 4
8.1.7 Parts list . . . . . 8 - 5

9.0 POWER SUPPLY MODULE OW0002 SPECIFICATIONS 9 - 1

9.0.1 Connector X800 . . . . . 9 - 1
9.0.2 Connector X820 . . . . . 9 - 1
9.0.3 Connector X830 . . . . . 9 - 1
9.0.4 Operation Principles: . . . . . 9 - 1
9.0.5 Parts list . . . . . 9 - 2

10.0 AUDIO . . . . . 10 - 1

10.0.1 Principles Of Audio Operation . . . . . 10 - 1
10.0.2 TX-Audio . . . . . 10 - 1
10.0.3 RX-Audio . . . . . 10 - 1
10.0.4 Regulator . . . . . 10 - 2
10.0.5 Audio . . . . . 10 - 2
10.0.6 Audio Input Signals . . . . . 10 - 3
10.0.7 Audio Output Signals . . . . . 10 - 3
10.0.8 Audio Settings . . . . . 10 - 4
10.0.9 Operating Voltages . . . . . 10 - 4
10.0.10 RX Audio . . . . . 10 - 4
10.0.11 TX-Audio . . . . . 10 - 5
10.0.12 Maximum Deviation . . . . . 10 - 5
10.0.13 FFSKT Deviation . . . . . 10 - 6
10.0.14 FII Deviation, Method 1 . . . . . 10 - 6
10.0.15 FII Deviation, Method 2 . . . . . 10 - 6
10.0.16 Limiter Adjustment . . . . . 10 - 7
10.0.17 Deviation Limiter . . . . . 10 - 7
10.0.18 Voice Operated HF . . . . . 10 - 7
10.1 Processor Functions . . . . . 10 - 8
10.1.1 The Processor Includes . . . . . 10 - 8

10.1.2 Connectors: . . . . . 10 - 9
10.1.3 Circuit Diagram . . . . . 10 - 11
10.1.4 Parts list . . . . . 10 - 16

11.0 PRINCIPLES OF HANDSET OPERATION . . . . . 11 - 1

11.0.1 Connector Signals: . . . . . 11 - 1
11.0.2 Audio . . . . . 11 - 1
11.0.3 Automatic Control For Keyboard And Lcd Backlight . . . . . 11 - 1
11.0.4 Leds . . . . . 11 - 1
11.0.5 Keyboard . . . . . 11 - 2

12.0 DATA-INTERFACE FUNCTION OUTLINE . . . . . 12 - 1

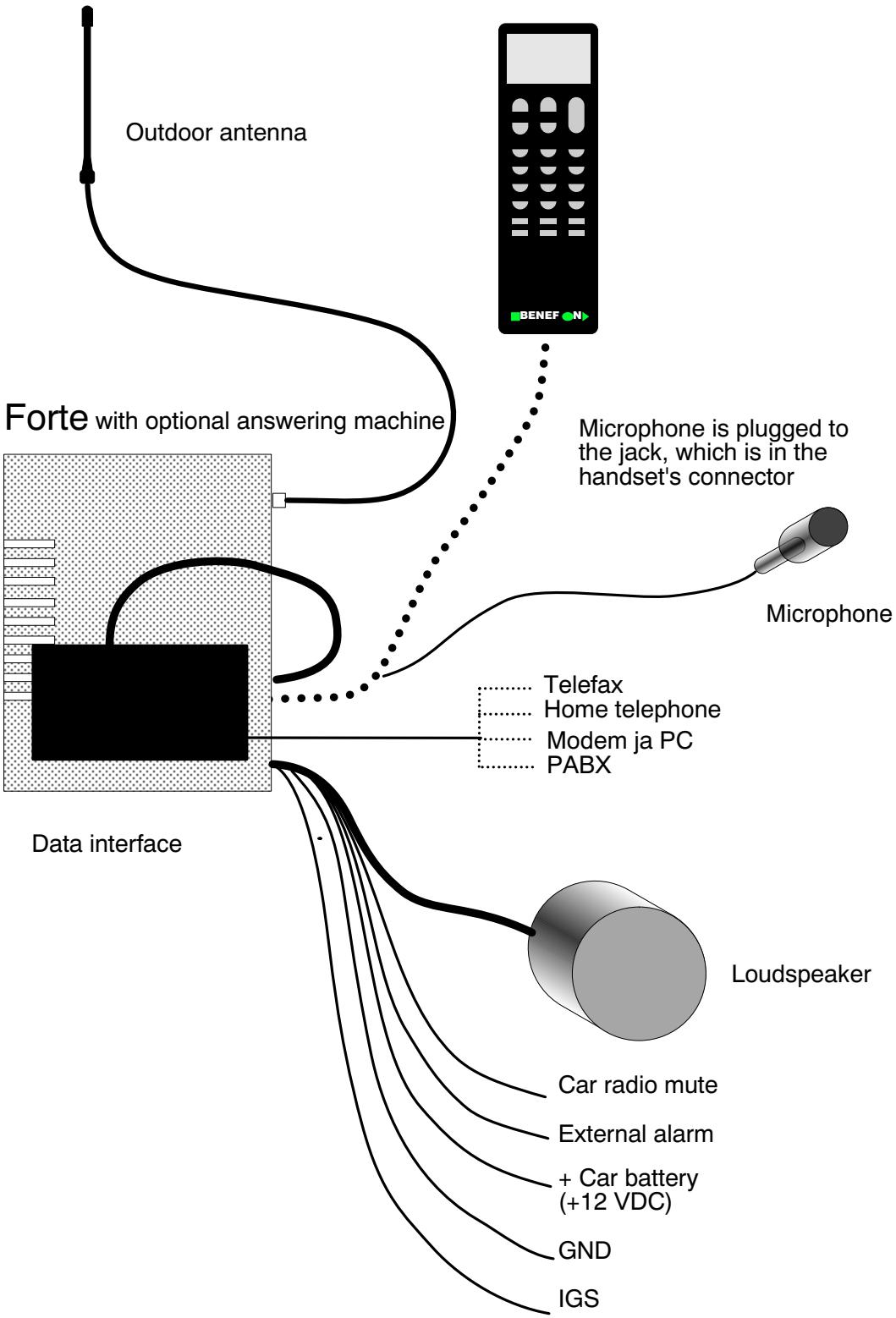
12.0.1 The Processor . . . . . 12 - 1
12.0.2 Memory Addresses . . . . . 12 - 1
12.0.3 Interrupts . . . . . 12 - 1
12.0.4 Processor I/O Functions . . . . . 12 - 2
12.0.5 Audio . . . . . 12 - 3
12.0.6 Ring- And Line-voltage Power Supply . . . . . 12 - 3
12.0.7 Parts list . . . . . 12 - 5

13.0 INSTALLATION OF ANSWERING MACHINE . . . . 13 - 1

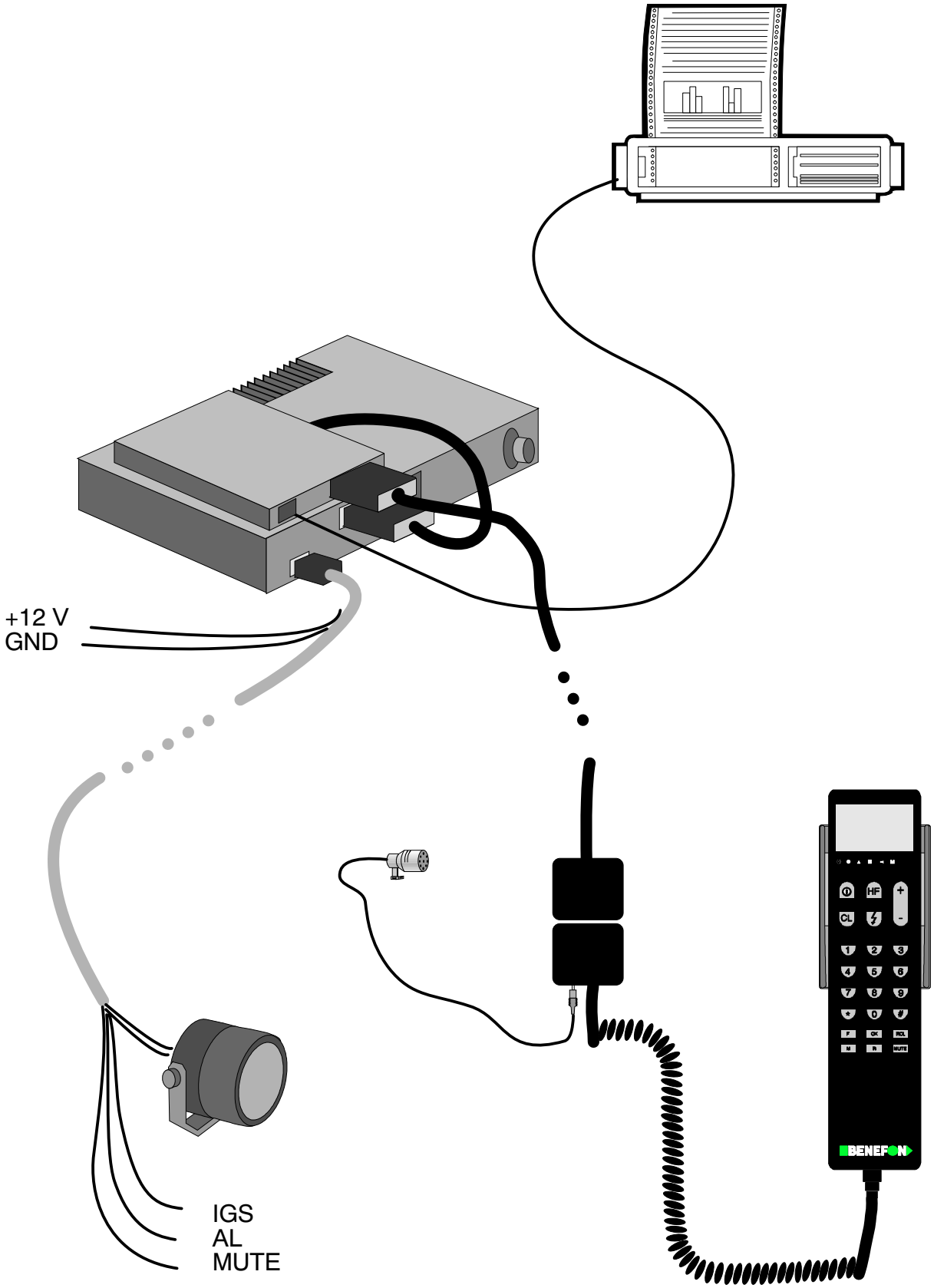
13.1 Answering Machine . . . . . 13 - 2
13.1.1 Processor . . . . . 13 - 2
13.1.2 Memory Control . . . . . 13 - 2
13.1.3 Watchdog . . . . . 13 - 2
13.1.4 Audio Paths . . . . . 13 - 2
13.1.5 ICC-Operation . . . . . 13 - 3
13.1.6 Operating Voltages . . . . . 13 - 3
13.1.7 Parts list . . . . . 13 - 4

1.0 GENERAL

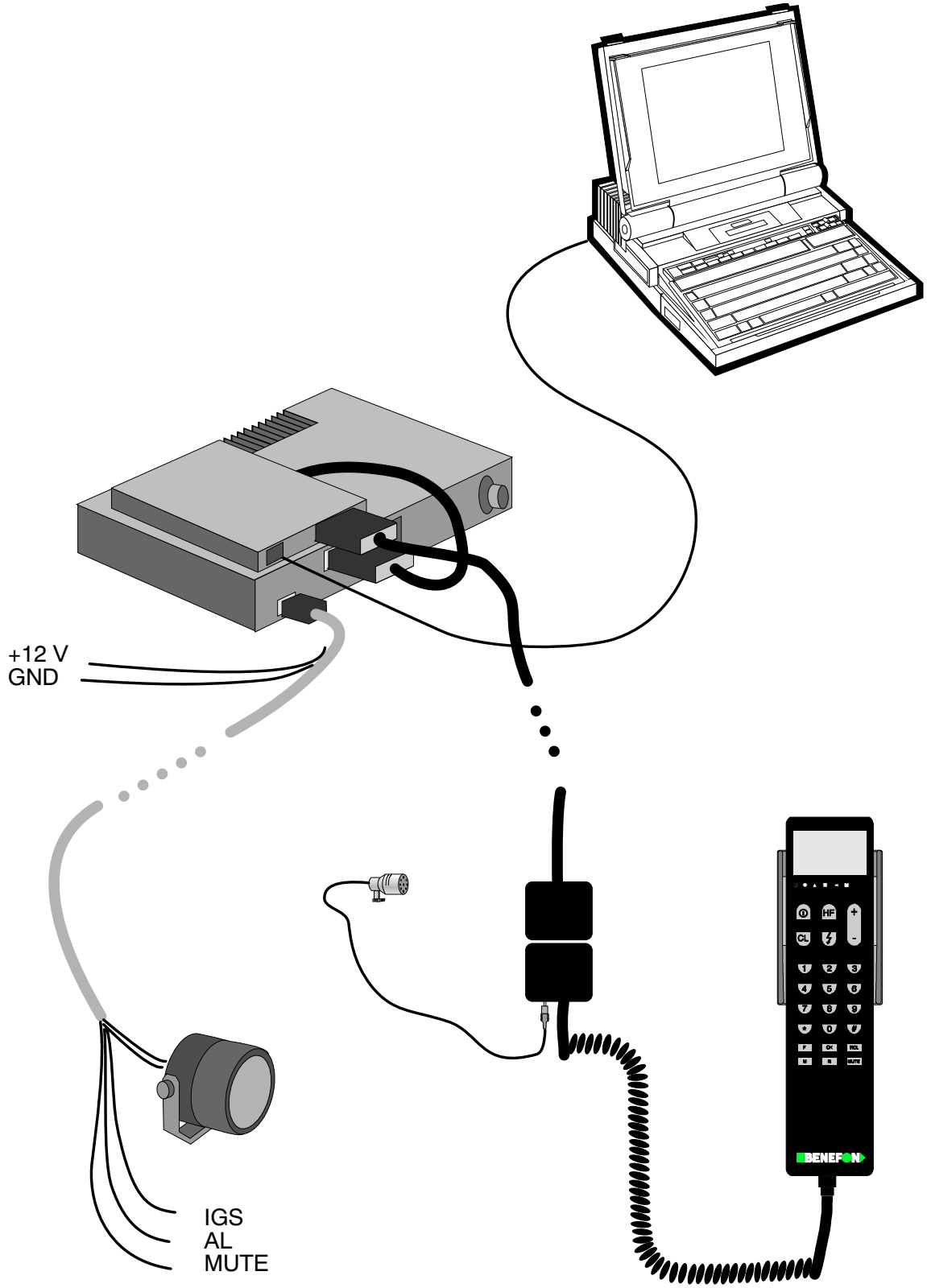
1.0.1 Benefon Forte and Data Interface



1.0.2 Benefon Forte and Fax



1.0.3 Benefon Forte and PC



2.0 INSTALLATION INSTRUCTIONS

Installation Instructions

PROLOGUE

These installation instructions have been prepared to assist fitters in installing the equipment, and are as such only to serve as a guide. Nothing beats common sense and good experience.

Installation is always based on the need of the customer to use the phone in the environment in which it will be installed. Negotiate with the customer where the different parts will be installed. It is important that the customer tells of his own preferences and choices, and that the fitter/salesman tells where it is possible/advisable to locate different items.

It is the salesman's responsibility to see that the installation order is properly filled out.

RECOMMEND

- antenna location on the roof
- handset location does not interfere with road safety
- speaker located in the driver's side leg-room
- microphone as close as possible to the driver's mouth
- car radio muting

ASK IF THE USER WANTS

- automatic start-up
- additional alarm
- car radio muting

Benefon Oy

CONTENTS

1.0.1 Techninal Data of Benefon Forte 3
1.0.2 Car Installation kit 3
1.0.3 Transceiver Unit Installation 3
1.0.3.1 Positioning the Mounting Bracket 4
1.0.3.2 Locking the Connector 4
1.0.4 Handset Installation 5
1.0.4.1 Holder Installation 5
1.0.4.2 Mounting the Handset Holder-Base 5
1.0.4.3 Removal of the holder 6
1.0.5 Speaker Installation 6
1.0.6 Microphone Installation 6
1.0.7 Voice-Controlled HF Installation 7
1.0.7.1 HF Tuning 7
1.0.8 Mounting the Cables 7
1.0.8.1 Power Connector 8
1.0.8.2 System Connector (Same Pinning in the System Cable) 8
1.0.9 Antenna Installation 9
1.0.9.1 On Car Roof 9
1.0.9.2 On Car Wing 9
1.0.9.3 On Boot Lid 9
1.0.9.4 On Vehicle Window 9
1.0.10 Connections 10
1.0.10.1 Power timer 10
1.0.10.2 Car Radio Muting 10
1.0.10.3 Additional Alarm 11
1.0.11 Identity Programming 11
1.0.11.1 Subscriber Number Programming 11
1.0.12 Combination Lock Programming 11
1.0.12.1 Sales Date Programming 12
1.0.13 Test Local Commands 12

2.0.1 Techninal Data of Benefon Forte

Operating Voltage	13.8 VDC	
Current consumption	0.25 A stby	4.5A TXon
Interfaces	Current-timer IGS - Car radio muting MUTE Additional alarm AL HF-microphone	
DTMF-transmitter	built-in	
DTMF-receiver	built-in	
Voice-controlled HF	built-in (requires separate micro-phone)	
Memories (tel.number)	99 + 2 memory places (0 RCL last-repeat dialling) 00 RCL memory search during phonecall (01-99 RCL shortcode memories)	

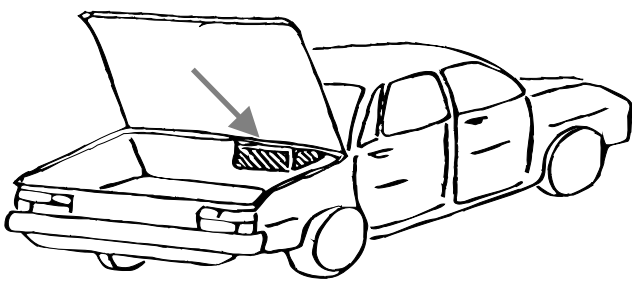
Alarm signals settings for frequenct, level (either increasing or fixed), cycle and tone (menu).

2.0.2 Car Installation kit

Number	Description
1	MUTE
2	IGS
3	GND
4	AL
5	SPKR

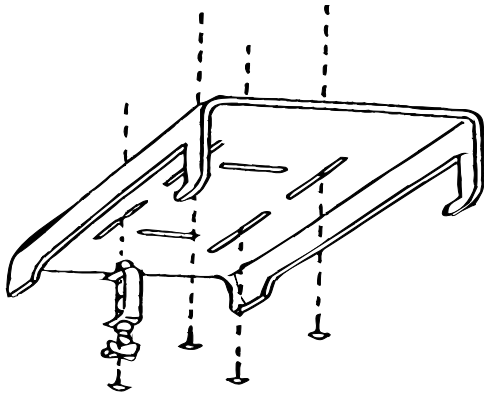
2.0.3 Transceiver Unit Installation

The mounting bracket can be installed in e.g. trunk.



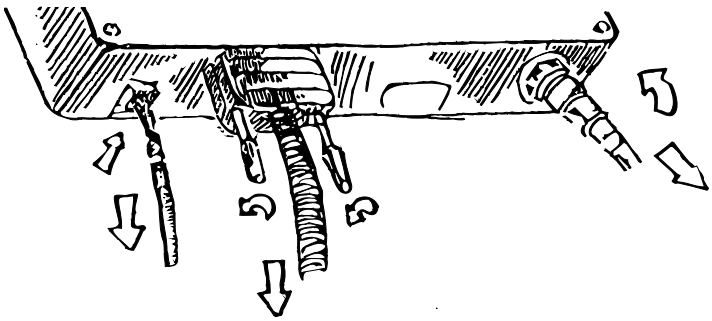
2.0.3.1 Positioning the Mounting Bracket

Should the telephone be requied also for indoor use, or in another vehicle, it is recommended to install the transceiver unit in an easily accessible place.



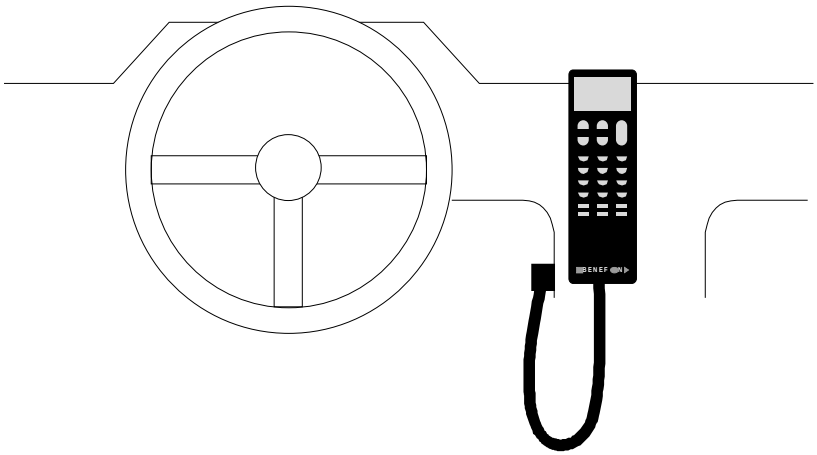
2.0.3.2 Locking the Connector

The antenna, system cable, and combined power/accessiry connector are fixed.

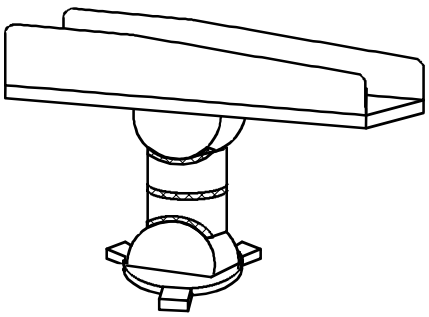


2.0.4 Handset Installation

The handset should be mounted to allow easy use and ensure safe operation



2.0.4.1 Holder Installation

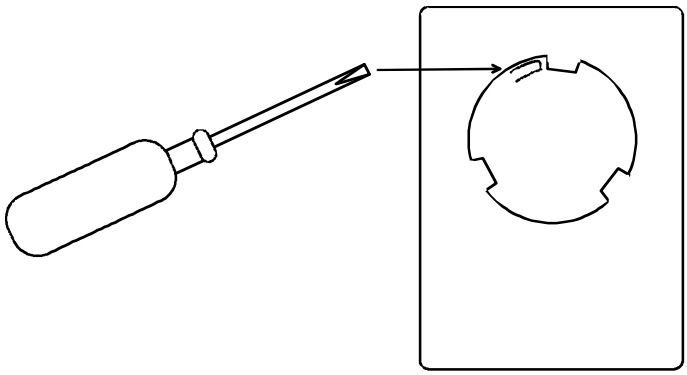


2.0.4.2 Mounting the Handset Holder-Base

Screw the handset holder-base in place, and snap the holder into position by twisting it carefully clockwise.

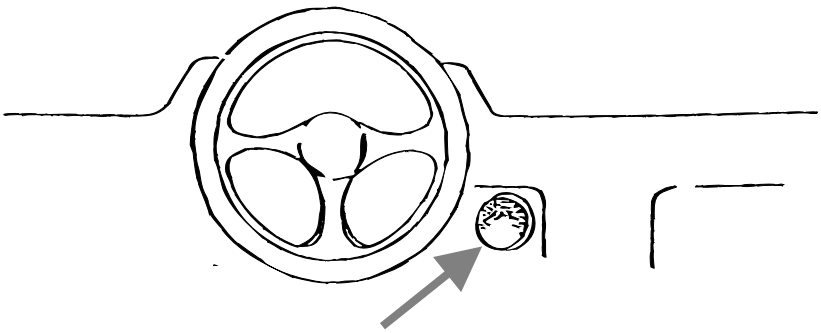
2.0.4.3 Removal of the holder

The holder can be removed by carefully pressing the locking-tab (back, left) and carefully turning the holder counter-clockwise.



2.0.5 Speaker Installation

For Hands Free operation, the best place to mount the speaker is on the dirver's side of the dashboard, pointing directly towards the driver. The speaker is connected with the connecting cable.

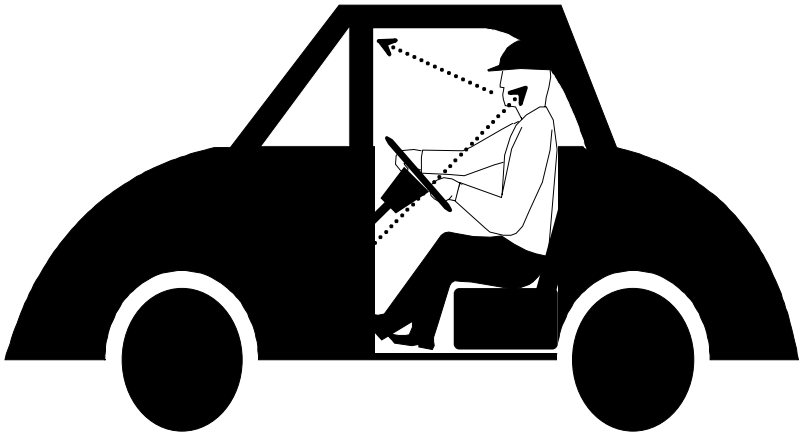


2.0.6 Microphone Installation

The following points should be noted when installing the microphone:

- the microphone must not be directed at the speaker
- it is not recommended to mount the microphone on a sun-blind, because the microphone direction will change with movement of the sun-blind
- the microphone must not be in the driver's line of vision, where it could be distracting

- maximum range from driver's mouth - about 20 cm
- the microphone is connected to the handset with a jack-plug
- it is not recommended to mount the speaker on a door-pillar or similar location due to the high background noise at the side of vehicle



2.0.7 Voice-Controlled HF Installation

To ensure trouble-free HF operation, be sure to mount the speaker and microphone carefully, as descriped on the previous page.

2.0.7.1 HF Tuning

With installation complete, connect loccal-box to both the handset spiral cable and the handset system cable, and set telephone to local mode; press 1# and start the vehicle; check the reading on the display for different revs, and press OK twice when it is at its greatest.

Best results are obtained when HF tuning can be accomplished with the vehicle moving at normal speeds.

Default value on display is 34, and the final value is 34 + compensation value. In practice 40...55, depending on the vehicle.

2.0.8 Mounting the Cables

There are two cables coming from the radio module: power and system cable.

The red supply cable connected to the battery.

With a 24 V supply, a voltage regulator must be used.

The black ground cable should be connected to a sufficiently firm place near the radio module.

2.0.8.1 Power Connector

Includes SPKR, GND, IGS, AL and MUTE connections.

Number	Description
1	MUTE
2	IGS
3	GND
4	AL
5	SPKR
6	+12v

2.0.8.2 System Connector (Same Pinning in the System Cable)

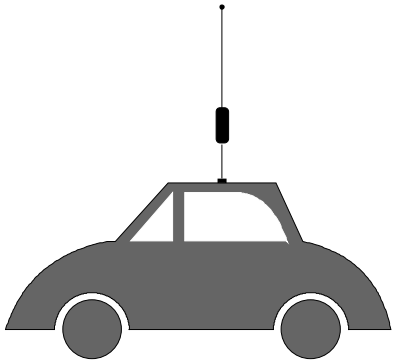
Number	Description
1	GND
2	MIC
3	AGND
4	AUTOCALL
5	-
6	TXDX
7	12CINT
8	SDAX
9	+9
10	ERP
11	-
12	PTT
13	-
14	RXDX
15	SCLK

2.0.9 Antenna Installation

2.0.9.1 On Car Roof

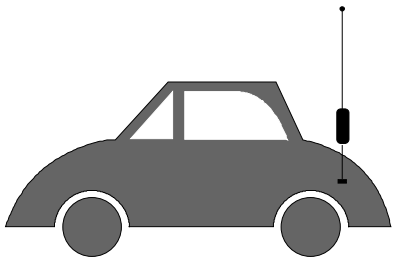
The most recommended antenna location is on the car roof.

+ highest location
+ circular radiation trace
+ no shadows
+ good grounding



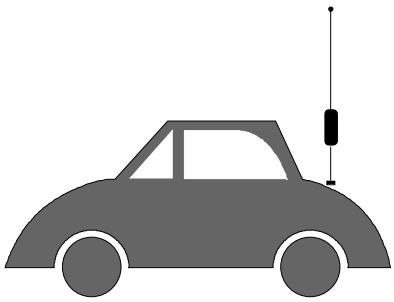
2.0.9.2 On Car Wing

+ easy to mount
- irregular grounding
- car body creates shadows



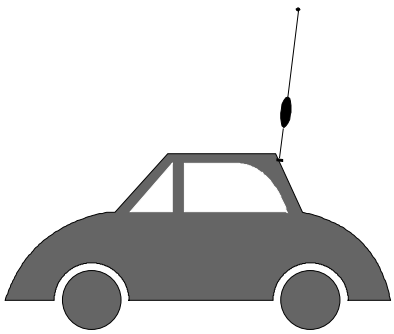
2.0.9.3 On Boot Lid

Not recommended under any circumstances
- causes constant duplex-interference



2.0.9.4 On Vehicle Window

+ no holes in the bodywork
- does not work as well as body mounting
- expensive



2.0.10 Connections

2.0.10.1 Power timer

IGS power timer is connected to the vehicle electrical system so that power on is VB and power off is OV, figure 1.

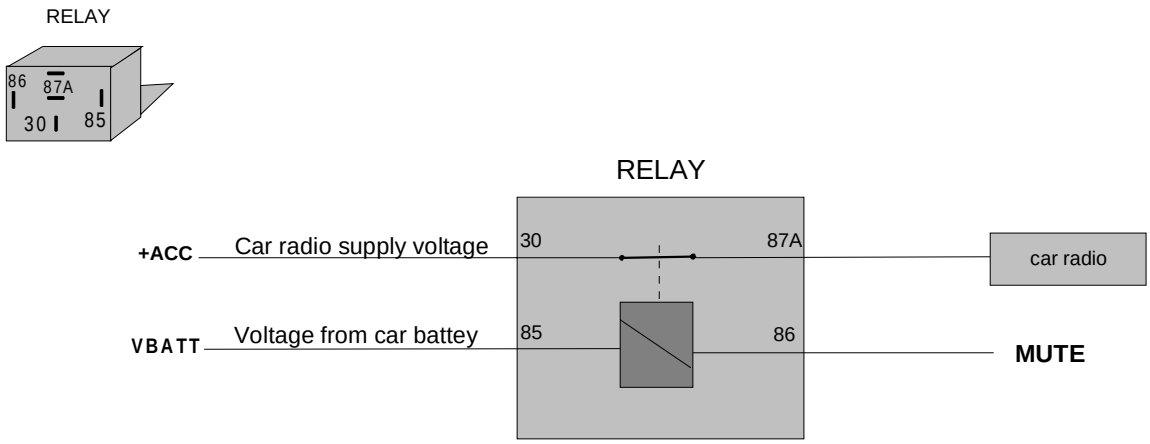
1	MUTE	
2	IGS	
3	GND	Caution!
4	AL	The same numbering is used with the power cable
5	SPKR	
6	+VB	

NOTE!

IGS connection must not be made to the ignition system.

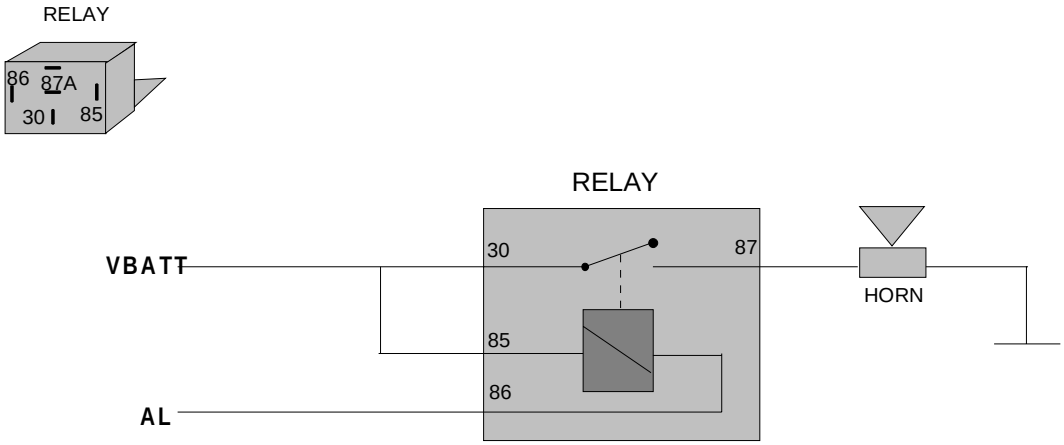
2.0.10.2 Car Radio Muting

MUTE car radio muting is connected with a connecting cable to the relay pins.



2.0.10.3 Additional Alarm

AL alarm system is connected with a 4-ply connector to either a relay or an extension. Alarm on/off is set by the handset menu.



2.0.11 Identity Programming

Connect a local-box with programming rights between the handset and the radio module; turn power on, and press 0#, and LOCAL will be shown on the display.

2.0.11.1 Subscriber Number Programming

Press 2#, and Z X1 X2 X3 X4 X5 X6 Y1 Y2 Y3, and finally OK

Z = country code X1...X6 = 6-digit subscriber number
Y1... Y3 = 3.digit password

Check:

Press 2*, in case of error, and start subscriber-number programming again.

2.0.12 Combination Lock Programming

Press 3#, and X1 X2 X3 X4, and finally OK

X1...X4 = customer-defined combination

Check:

Press 3*, in case of error, and start combination lock programming again.

2.0.12.1 Sales Date Programming

Press 4#, and XX XX XX, and finally OK

XX XX XX = d mm yy, for example 08 0

Check:

Press 4*, in case of error, and start sales date programming again.

2.0.13 Test Local Commands

Command	Function
0#	Transfer to LOCAL mode
1#	HF tuning OK adjustment OK end
2#	Subscriber number programming, and OK
2*	Check subscriber number
3#	Combination lock programming (4 digits) and OK
3*	Check combination lock
4#	Sales date programming (6 digits) and OK
4*	Check sales date
5#	Change call country. Call country on the display - enter new call coun with +/- buttons, store with OK
6#	Additional Alarm on
6*	Additional alarm OFF
7#	Car radio mute ON
7*	Car radio mute OFF
8#	Reads IGN, HOOK, PTT, and AUTOCALL lines
9#	Transfer shortcodes to LOCAL-BOX
999*	Transfer shortcodes back to radio module

3.0 OWNER’S MANUAL

4.0 LOCAL SERVICE COMMANDS

4.0.1 General

There is a special program module called LOCAL which makes it possible to set, read and program various features of the phone.

In order to activate the LOCAL program it is necessary to connect a local box between the radio unit and the handset. When the power is switched on, and the local box is connected, the LOCAL program becomes activated.

There are two kinds of local boxes. One merely has "service rights", i.e. you cannot program subscriber number. The other has "full rights", i.e. there are no restrictions in LOCAL.

4.0.2 Special Push Buttons In Local

Button	Action
R	Changes between LOCAL and NMT program
HF	Changes between earphone and speaker -HF-led indicates speaker mode-
SND/END	Ends local command influence
MFT	Used for scrolling letters A, b, C, D, E, F (accepts either with OK or digit button)
+/-	Volume settings

4.0.3 General Form Of Commands

X(XX)#	DO
X(XX)*	UNDO corresponding X(XX)# command
XXXX#	Channel command
XXXX*	BURN-IN channel (default = 45)

Note:

In LOCAL mode * = b and # = C

4.0.4 Local Commands

4.0.4.1 INSTALL AND PURCHASE X

0# Reset LOCAL

1# Tune HF microphone threshold
- Background noise level appears on display. Push OK to add registered level to default (set level can be corrected with digit buttons).
- store with OK

2# Program subscriber number (needs local box with "full rights")
- push Z X1 X2 X3 X4 X5 X6 Y1 Y2 Y3 (ten digits)
Z = Country code
X1...X6 = subscriber number
Y1...Y3 = password
- store with OK

2* Read subscriber number

3# Program lock code
- push four digits
- store with OK

3* Read lock code

4# Program purchase date
- push six digits (ddmmyy)
- store with OK

4* Read purchase date

5# Change countrycode
- give new country (5...8) or select with +/- button
- store with OK

6# External alert ON

6* External alert OFF

7# Car radio mute ON

7* Car radio mute OFF

8# Read IGN / HOOK / PTT / AUTOCALL in realtime

9# Move shortcode memory from the phone to the local box

999* Move shortcode memory from the local box to the phone

4.0.4.2 Read And Write Port 0X

00# Write to port
- push (portnumber) (bitnumber) (bitstate)

portnumber:	0	1. latch in processor-module
	1	2. latch in processor-module
	2	3. latch in processor-module
	3	4. latch in processor-module
	4	handset "button port"
	5	handset "led port"
	A6	processor PA
	D	processor PD
bitnumber:	0...7	
bitstate:	0 or 1	

01# Read port in realtime
- push (portnumber)

portnumber:	0	processor-module input-latch
	1	IICINT / PTT / HOOK

02# Read A/D-channel in realtime
- push (channelnumber)

channelnumber:	0	RSSI
	1	TXSENSE
	2	MICDET
	3	ERPDET
	4	HOOK
	5	PTT
	6	POTIND
	7	not in use

4.0.4.3 Processor Tests 1X

10# Test memory
- EPROM fail XX1, no fail XX0
- EEPROM fail X2X, no fail X0X
- RAM fail 3XX, no fail 0XX

11# Test COP (= watchdog)
- Resets phone if COP is in order, otherwise stops

12# Send "0"-frequency
- Doesn‘t set transmitter

12* End send

13# Send of "1"-frequency
- Doesn‘t set transmitter

13* End send

14# Send frame
- frame is given by push button set (16 digits and #)
N1 N2 N3 P(X) Y1 Y2 Z X1 X2 X3 X4 X5 X6 J1 J2 J3 #
- default frame is 15
- letters A...F are given with MFT-button

14* End send

15# Receive frame

16# Detect FSK in realtime

17# Receive DTMF

18# DTMF loop test

4.0.4.4 Audio Tests 2X

20# AUDIOPWR = 1

20* AUDIOPWR = 0

200# Compander ON

200* Compander OFF

21# TX-audio ON
-AUDIOPWR = TXAON = 1
- MICVOL = 111
- microphone = MIC if ERPON, EXTMIC if SPKON

21* TX-audio OFF
- TXAON = 0
- microphone OFF

22# RX-audio ON
- AUDIOPWR = RXAON = ERPON = 1
- AUDIOLOOP = SPKON = 0
- ERPVOL = 011

22* RX-audio OFF
- RXAON = 0

23# Fiiloop ON
- AUDIOPWR = FIILOOP = 1

23* Fiiloop OFF
- FIILOOP = 0

24# FFSKT ON
- AUDIOPWR = FFSKT = 1

24* FFSKT OFF
- FFSKT = 0

25# Audio-tone generator ON
- AUDIOPWR = DTMFON = 1
- DTMF generator output = 980 Hz

25* Audio-tone generator OFF
- DTMFON = 0

- DTMF generator output = OFF

26# Auxiliary pass ON
- AUDIOPWR = AUXOFF = 1

26* Auxiliary pass OFF
- AUXOFF = 0

27# Audioloop ON
- AUDIOPWR = AUDIOLOOP = 1

27* Audioloop OFF
- AUDIOLOOP = 0

28# Microphone volume settings +/-

28* Earphone/speaker volume settings +/-

29# Handset microphone ON

29* Microphone OFF

4.0.4.5 Transmitter And Receiver Tests 3X, 4X

30# Transmitter ON in previous txpower

30* Transmitter OFF

31# Transmitter ON in low txpower

31* Transmitter OFF

32# Transmitter ON in medium txpower

32* Transmitter OFF

33# Transmitter ON in high txpower

33* Transmitter OFF

34# TXVCO ON

34* TXVCO OFF

35# First channel

36# Middle channel

37# Last channel

38# Tune and program RSSI levels
- Display shows level to tune (in dBm‘s)
PG-53, PG-63, PG-93, PG-103, PG-115
- Push OK to tune next level
- Push OK to store after tuning -115 dBm
- (If you want store values before tuning -115 dBm push RCL)
- Store is done if tuned values are -53 dBm > = -63 dBm > = -115 dBm

38* Read programmed RSSI-levels

39# Tune and program deviation limit levels
- Display shows level to tune DEV LO, DEV HI
- Push OK to tune next level
- Push OK to store after tuning DEV HI
- (If you want store DEV LO before tuning DEV HI push RCL)
- Store is done if tuned values are DEV HI > = DEV LO

39* Read programmed audiolimiter levels

40# RX path measurement in middle channel
- AUDIOPWR = RXAON = ERPON = AUXOFF = 1
- TXON = TXVCO = AUDIOLOOP = FIILOOP = SPKON = 0
- ERPVOL = 111

41# TX path measurement in middle channel high txpower
- AUDIOPWR = TXVCO = TXAON = 1
- FFSKT = DTMFON = AUDIOLOOP = FIILOOP = 0
- ERPVOL = 111

42# RX path measurement in middle channel high txpower
- AUDIOPWR = TXVCO = FIILOOP = RXAON = ERPON = AUX-OFF= TXAON = 1
- AUDIOLOOP = SPKON = FFSKT = DTMFON = 0
- MICVOL = 111, ERPVOL = 011

43# Channel scan
- starts from current channel

44# Step channels with +/- button

4.0.4.6 Handset And Accessory Tests 5X

50# Display, leds and illumination ON

50* Display, leds and illumination OFF

51# Answering-machine loop test

4.0.4.7 Read Information 6X

60# Read power off counters

0	RAM fail
1	EPROM fail
2	EEPROM fail
3	COP fail (not used)
4	No RSSI in conversation
5	Transmitter ON during scan

6	No Handset
7	FSK detected in conversation

60*	Reset all power off counters
61#	Read sellercode
62#	Read program version (ddmmyy)
70#	Tune FSK split level - store with OK key
70*	Read FSK split level
71#	Base-band programming
71*	Read Base-band

4.0.4.8 Clearing Of Memory 8X

80#	Clear RAM
81#	Clear EEPROM - not the tuned values
810#	Clear whole EEPROM
82#	Clear RAM and EEPROM -not the tuned values

4.0.4.9 Burn-in 9X

98#	Start BURN-IN if enabled
98*	Stop BURN-IN if IGN not connected
99#	Enable BURN-IN
99*	Disable BURN-IN
100#	SIM using normal SAK number - defaul value always when phone is ON
100*	SIM using test SAK number

4.0.5 Guide Texts And Error Situations

After switching power the display shows LOCAL. Along with a local command, a guide text always appears, explaining the given command.

The following list shows the most common error situations.

ERROR on the display:

1. Error in local command
2. Failed EEPROM programming
3. Wrong input data to EEPROM
- Length of data
- Erroneus digits
- RSSI-levels or deviation limit levels are not in propersuccession
4. Loop test has failed
5. BURN-IN test cannot be activated when not enabled

UNKNOW on the display:

Unknown local command

LOCAL on the display though there is no local box:

BURN-IN test is enabled or subscriber number is not programmed.

4.0.6 Local-Box

4.0.6.1 General

LOCAL = operating mode where it‘s possible to give commands to set, read and program the MS features.

To get the MS to LOCAL a local-boxes, one merely has "service rights" i.e. you cannot program subscriber number. The other has "full rights", i.e. there are no restictions in LOCAL.

Each box has it‘s own serial number. Serial number and programming rights are installed by manufacturer. Serial number is used for identifying the subscriber number programmer and it is stored automatically to MS during programming.

There is text LOCAL on the display when the local box is connected and power is switched on.

4.0.6.2 Features Of Local-box

Switching ON/OFF the power supply:

- Set NORMAL/SERVICE switch NORMAL position

To be measured from audio of the radio unit:

- Set NORMAL/SERVICE switch SERVICE position and RADIO/HANDSET switch RADIO position.

GEN:	-norm dev = 1 Vrms - max dev = 3.33 Vrms
METER: SERVICE/HANDSET	- norm dev = 300 mVrms - max dev = 600 mVrms (VOL = 0dB)

To measure handset audios:

- Set NORMAL/SERVICE switch NORMAL position and RADIO/HANDSET switch HANDSET positon

BNC-connectors:

GEN:	-norm dev = 300 mVrms - max dev = 600 mVrms
METER:	

4.0.6.3 Internal Ram

Local-box‘s internal RAM is intended for not losing the contents of shortcode memory during service operations.

Commands	9#	store shortcode memory to local-box
	999*	store shortcode memory to MS.

5.0 TUNING INSTRUCTIONS

5.0.1 Connect To Phone

- operating voltage (13.2V, X800 connector, loudspeaker needed)
- local-box (between handset and radio unit)
- RF-generator/power-meter

5.0.2 Synthesizer

Check-up of operating voltages

Input-connector V401 **pin1**	13.2 V	
TP1	8.6...9.4 V	
TP2	4.5...5.3 V	
TP7	13...15 V	
+ TX on (local **34#**)	8.5...9.3 V	**TP3**
+ TX off (local **34***)	approx 5 V	**TP3**

5.0.3 RX-VCO

Switch synthesizer to first channel (local **35#**)

Measure voltage synthesizer unit **TP6**, adjust voltage C435(RX-VCO) to 3 V

Change to last channel (local **37#)**

Check that the adjusting voltage is approx 6 V

5.0.4 TX-VCO

Start TX-VCO (local **34#)**

Switch synthesizer to first channel (local **35#)**

Measure **TP4** voltage, adjust voltage by C498 (TX-VCO) to 5 V

Change to last channel (local **37#**)

Check that the adjusting voltage is now approx 7.5...8.5 V

5.0.5 Channel Frequency Adjustment

Start transmitter (local **33#**)

Change to first channel (local **35#**)

Adjust channel frequency MHz (+/-100 Hz) with TCXO trimmer

5.0.6 Transmitter

Set operating voltage to 15.6 V

Switch on transmitter (local **33#**)

Adjust audio/pros unit R162 (TX-POW) transmitter power to 41.8 dBm

Set operating voltage to 10.8 V, check the transmitter power.

Difference max +/-1.5 dB

Check **32#** 31.8 dBm

Check **31#** 21.8 dBm

5.0.7 TX-Audio

Feed 1 kHz, 1 V RMS signal to local box GEN-connector.

Switch on TX-audio, mic off (local **21#**, **29***).

Measure the processor unit x-synte connector pin 2 , and adjust (maximum) level of R241 to 550 mV RMS.

Switch transmitter to medium power, center channel (local **32#**, **36#**).

Adjust R459 (syntyhesizer-module) deviation to 3 kHz.

Check the deviation in channels (1, 180); difference must not exceed 150 Hz. Change TX-VCO adjusting voltage if necessary (range in use approx 3...10 V).

Adjust R459 (MOD) again.

Drop the af.gen level until deviation is 1 kHz, measure V401 pin 2 in synthesizer, write down the level.

Change af.gen frequency to 300 Hz.

Raise the af.gen level until V401 pin 2 level is equal to the reference level mentioned before.

Adjust R457 deviation (with COMP.OS-module) to 1 kHz.

5.0.8 Max DEV

Feed pt.gen frquency 1 kHz, 3.33 Vrms.

Check deviation in channels (1, 90, 180).

Deviation must be within the limits 4.0...4.5 kHz; if it exceeds 4.5 kHz, adjust R244 (with MAX OA-module). Reset (local **0#**)

5.0.9 FFSKT

Switch on medium power (local **32#)**.

Switch on FFSKT (local **12#**).

Adjust R265 deviation (FFSKT) to 4.2 kHz.

Reset (local **0#**).

5.0.10 RX-Audio

Set RF-generator frequency 465.225 MHz, level -57 dBm, mod freq 1 kHz, deviation 3 KHz.

Set channel 90 (local **36#**, **22#**).

Expander ON (local **200#**).

Adjus LF output level R302 (RX) 300 mV RMS, measure at METER-connector (local-box)

Reset (local **0#**).

5.0.11 RX-Response

Set RF-generator values as above, except for level -113 dBm.

Switch on high-power, RXA on (local **33#**, **22#**)

Measure SINAD CCITT min. 20 dB.

Also check channels (1, 180).

RF-generator frequency 463.000 MHz (**35#**)

467.475 MHz (**37#**)

5.0.12 RX-Distortion

Set center channel, high-power (local **36#**, **33#**).

RF-generator frequency 465.225 MHz, level -57 dBm.

Measure distortion, max 5 %.

Reset by **0#**.

5.0.13 TX-Distortion

Set center channel high-power, TXA on, mic off (local **36#**, **33#**, **21#**, **29***).

Feed 1 kHz, 1 V RMS signal to local-box GEN-connector.

Measure distortion, max 5 %

Reset (local **0#**).

5.0.14 FII DEV

Set RF-generator frequency 465.225 MHz, level -57 dBm, modulation frequency 4 kHz, dev 300 Hz.

Switch on fiiloop (local **23#**), power (**32#**).

Adjust R255 deviation to 300 Hz.

Reset (local **0#**).

5.0.15 Tuning The RSSI-Levels

Set RF-generator frequency 465.225 MHz, level -53 dBm.

Switch on RSSI tuning (local **38#**).

Display shows "PG-53".

Wait until reading on the display settles down. Press OK.

Change RF-level to -63 dBm.

Phone display shows "PG-63"

Press OK.

Change RF-level to -93 dBm.

Phone display shows "PG-93

Press OK.

Change RF-level to -103 dBm.

Phone display shows "PG-103

Press OK.

Change RF-level to -115 dBm.

Phone display shows "PG-115

Press OK.

Check tuning (local **38***).

5.0.16 Tuning FSK-split level

RF-generator settings

Freq. 465.225 MHz, level -53 dBm ,mod freq 1 kHz, dev 350 Hz

Give local-command **70#**. Handset display show value 20...30.

Store value by pressing **OK** button.

5.0.17 Program Base-Band (if neccessery)

Give local command **71#**. Press **1** and **OK**

Press **180** and **OK**.

5.0.18 Programming The Subscriber Number

Requires local-box with programming rights.

Give local-command **2#**.

Feed 10 digits, and press **OK** (country code + subcriber number + password)

Check **2***.

6.0 TRANSMITTER MODULE OT0001 SPECIFICATIONS:

OT0001 Transmitter

Operating voltage 10.8...15.6 VDC

Current consumption max 4.5 A

Input power level 10 dBm (+2/-2 dB)

Output power level max 44 dBm (25 W) without a duplex filter

Frequency range 453.000...457.475 MHz

6.0.1 Connector Description:

4-pole connector:

pin 1, voltage from directional coupler max 10 V

pin 2, control voltage for RF-power max 8 V

pin 3, bias for the preamplifiers 8 V

pin 4, GND

6.0.1.1 Transmitter operation:

The transmitter is a 5-stage amplifier chain. The two preamplifiers (Q600/601) operate in class AB as linear amplifiers. The final amplifier (I600) is a class C power module. The output power is controlled with a loop: A signal coming from the directional coupler is rectified and filtered. Then it is fed through processor controlled voltage attenuator to the integrator, which has a preset reference voltage (a corresponding value for 15 W output power). The control voltage from the integrator is amplified in DC-amplifier (Q610/611) and fed to the preamplifiers/the first stage of the power module. RF-power input has a 6 dB attenuator to improve impedance matching between synthesizer and transmitter in different power level conditions.

6.0.2 Tuning Instructions:

Tuning can be done in local mode or using CMT-tester.

Set a power supply to 15.6 V.

Input signal 10 dBm (10 mW) on channel 090 from the synthesizer or signal generator.

Connect a 50 ohm dummy load and a power meter to the antenna connector.

Transmitter on (33#).

Tune output power with trimmer R162 on OA0014 (audio/processor) -module to 41.8 dBm (15 W).

Set a power supply to 10.8 V and check output power. It should be about the same value as set before (+/-1.5 dB).

Set a power supply to 13.2 V.

Check power levels:

High 41.8 dBm (15 W) +/-1.5 dB (33#)

Medium 31.8 dBm (1.5 W) +/-3 dB (32#)

Low 21.8 dBm (0.15 W) +/-3 dB (31#)

Power off (31*)

Tuning is completed.

Some useful local mode commands for the transmitter operation checking:

Channel	001	35#
	090	36#
	180	37#
high power on/off		33#/33*
medium power on/ off		32#/32*
low power on/off		31#/31*

6.0.3 Test Point Voltages

Set the power supply to 13.2 V

Typical DC-values measured with a universal meter Ri = 10 Mohm (Philips PM 2505).

Power level	H	M	L
TP1	2.0	2.0	2.0
2	1.4	1.3	1.1
3	4.6	3.4	2.1
4	0.7	0.7	0.7
5	5.5	3.3	3.0

Typical RF-voltages measured with R&S millivoltmeter URV-3.

Power level	H	M	L
TP1	0.4	0.4	0.4
2	0.15	0.06	0.04
3	0.85	0.65	0.55
4	0.28	0.3	0.32
5	3.6	2.7	2.4

Values can vary +-10 %. All values indicated as volts.

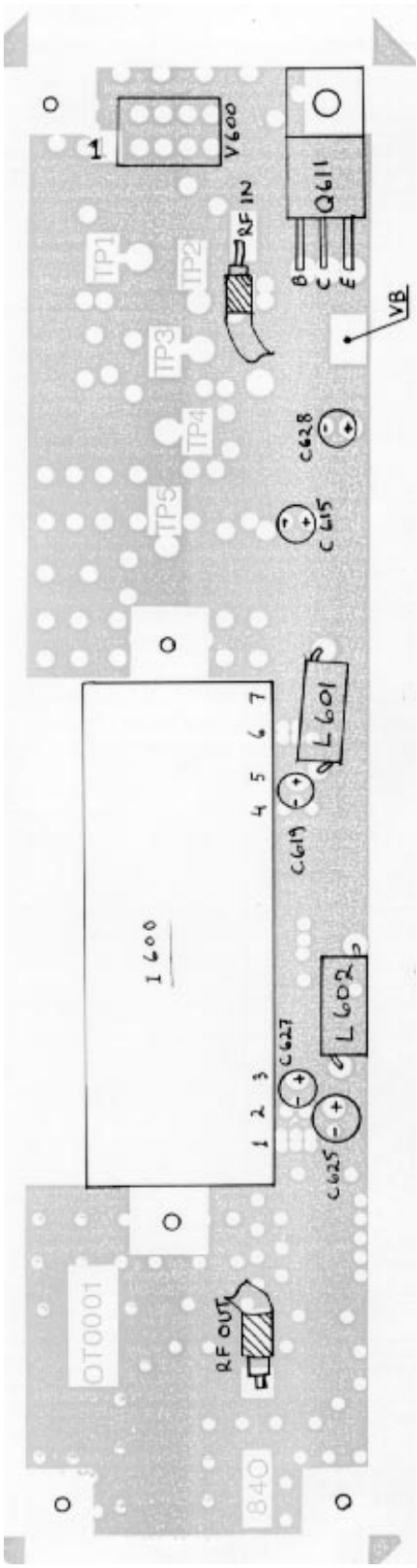
6.0.4 Parts list

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
CC0471	C601	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0101	C602	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0101	C603	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0471	C604	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0101	C605	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0101	C606	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0471	C607	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CU0105	C609	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0472	C610	SMD capasitor	4.7 nF 10% 50 V X7R	Philips	
CC0471	C611	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0471	C613	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0471	C614	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CE0105	C615	Al elko	1uF/63V 4x7mm	Philips	2222 097 58108
CC0471	C616	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0471	C617	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0473	C618	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CE0105	C619	Al elko	1uF/63V 4x7mm	Philips	2222 097 58108
CC0471	C620	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0101	C621	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0101	C622	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0101	C623	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0471	C624	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CE0476	C625	Al elko	47 uF/25 V 7x7mm	Philips	2222 097 56479
CC0473	C626	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CE0105	C627	Al elko	1uF/63V 4x7mm	Philips	2222 097 58108
CE0105	C628	Al elko	1uF/63V 4x7mm	Philips	2222 097 58108
CC0101	C629	SMD capasitor	100 pF 5% 50V NP0	Philips	
DZ0569	D620	SMD zener	5V6 5% 300mW	Philips	BZX84C5V6
DY0074	D623	Shottky diode		Philips	BAT 74
IW0720	I600	RF-power amplifier	450-460MHz	Motorola	MHW720A2X
LF0396	L601	Inductor	39 uH	Philips	
LF0396	L602	Inductor	39 uH	Philips	
PT0001	PCB	PCB for OT0001	155 x 36 x 1.6		
QA5634	Q600	SMD RF-transistor	NPN 1 W 5 GHz	NEC	NE85634
QA0035	Q601	SMD RF-transistor	NPN Wideband 1GHz	Philips	BFG-35
QSB848	Q610	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QP0032	Q611	Power transistor	PNP 3A/60V	Philips	BDT 32 AF
RC0151	R600	SMD resistor	150 R 5% 0.125 W	Kamaya	
RC0151	R601	SMD resistor	150 R 5% 0.125 W	Kamaya	
RC0390	R602	SMD resistor	39 R 5% 0.125 W	Kamaya	
RC0471	R603	SMD resistor	470 R 5% 0.125 W	Kamaya	
RC0152	R604	SMD resistor	1.5 k 5% 0.125 W	Kamaya	
RC0330	R605	SMD resistor	33 R 5% 0.125 W	Kamaya	
RC0330	R606	SMD resistor	33 R 5% 0.125 W	Kamaya	
RC0221	R608	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0331	R610	SMD resistor	330 R 5% 0.125 W	Kamaya	
RC0391	R611	SMD resistor	390 R 5% 0.125 W	Kamaya	
RC0222	R612	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0223	R613	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0100	R614	SMD resistor	10 R 5% 0.125 W	Kamaya	
RC0100	R615	SMD resistor	10 R 5% 0.125 W	Kamaya	
RC0100	R616	SMD resistor	10 R 5% 0.125 W	Kamaya	
RC0222	R620	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0102	R621	SMD resistor	1 k 5% 0.125 W	Kamaya	
RM1502	R622	Mini-Melf resistor	15k0 1% 0.25W	Beyschlag	MMA 0204-50
RC0103	R623	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0472	R624	SMD resistor	4.7 k 5% 0.125 W	Kamaya	

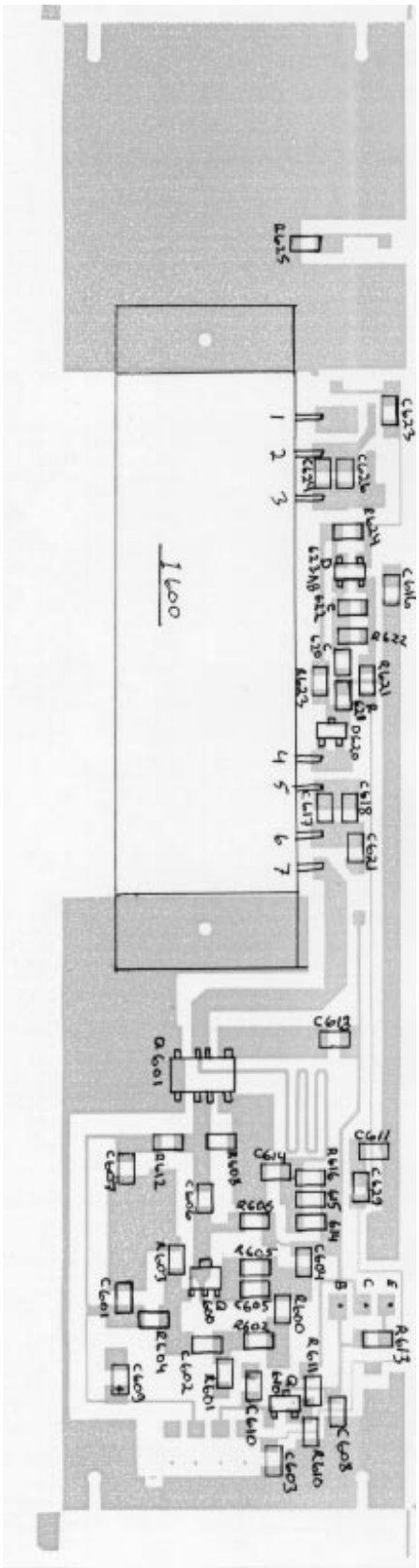
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
RC0820	R625	SMD resistor	82 R 5% 0.125 W	Kamaya	
VN0104	V600	4-pin connector		Wisher	WKP-N4B1G-L
VR0235	V601	Coax cable + connector	50 ohm l=n.70mm	Taikodenki	TMP-P01X-A1
VR0122	V625	SMB + coax	l=22 cm	Radiall	

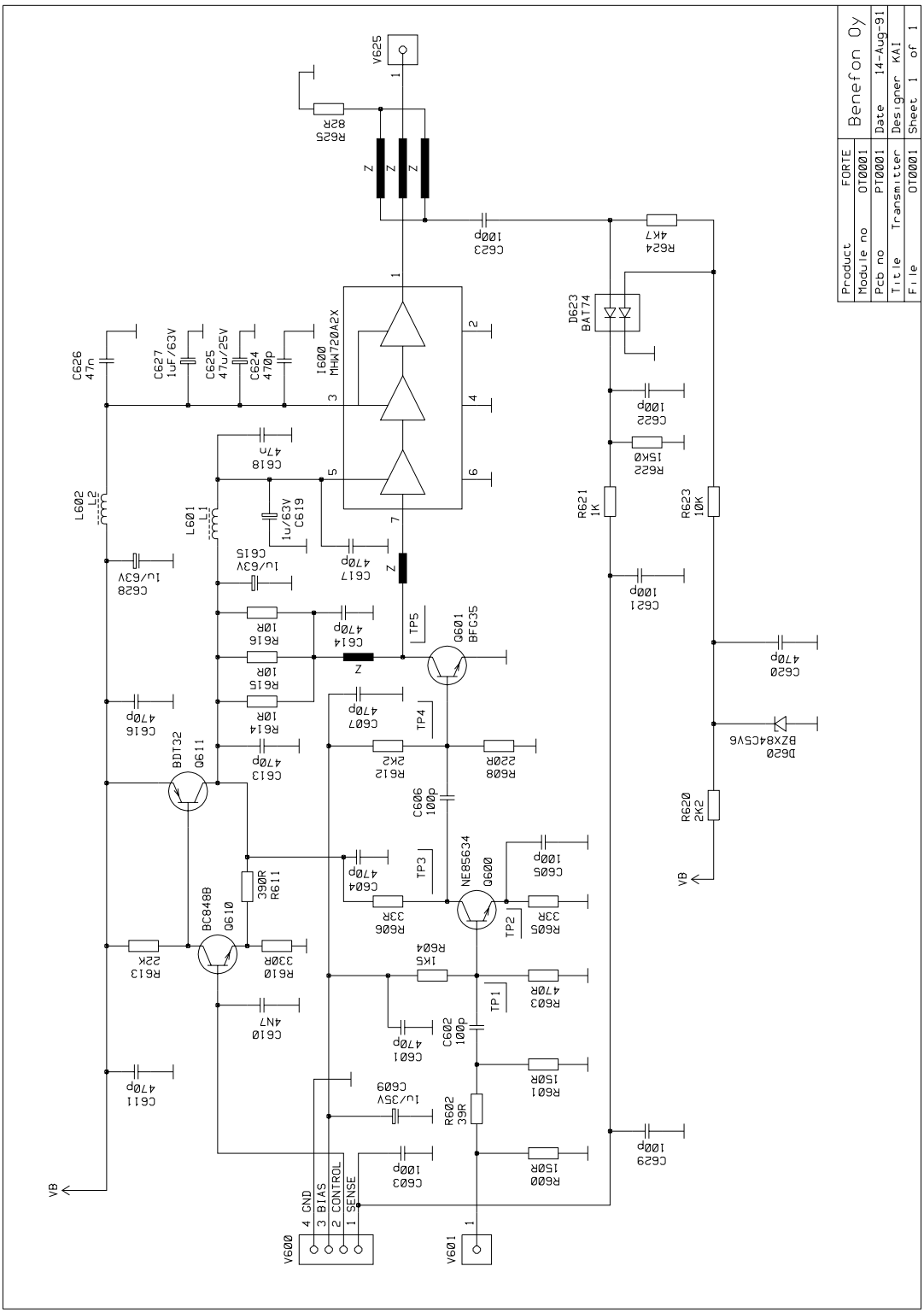
Last
update
14.08.91

Component Side Layout PT0001A0 (Schematic OT0001A0)



Solder Side Layout PT0001A0 (Schematic OT0001A0)




Benefon Oy
Product FORTE
Module no OT0001
Pcb no PT0001
Title Transmitter
File OT0001
Date 14-Aug-91
Designer KAI
Sheet 1 of 1
V625
R625 82R
C623 100p
R624 4K7
D623 BAT74
C622 100p
R622 15K0
R621 1K
R623 10K
C621 100p
C620 470p
D620 BZX84C5V6
R620 2K2
VB
C626 47n
C627 1uF/63V
C625 47u/25V
C624 470p
IC600 MAX720A2X
C618 47n
L602 L2
L601 L1
C619 1u/63V
C628 1u/63V
C615 1u/63V
C617 470p
R616 10R
C614 470p
TP5
Q601 BFG35
R615 10R
R614 10R
C607 470p
TP4
C616 470p
Q611 BDT32
C613 470p
R612 2K2
R608 220R
C606 100p
C604 470p
TP3
Q600 NE85634
C605 100p
R606 33R
R605 33R
TP2
R613 22K
Q610 BC848B
R611 390R
R610 330R
R604 1K5
R603 470R
TP1
C610 4N7
C601 470p
C602 100p
C611 470p
C609 1u/35V
R602 39R
R601 150R
R609 150R
C603 100p
C629 100p
V600
4 GND
3 BIAS
2 CONTROL
1 SENSE
V601

7.0 RECEIVER MODULE OR0002 SPECIFICATIONS

OR0002 Receiver

7.0.1 Principles Of Receiver Operation

The module includes all operational segments of FM receiver.

RF-amplifier	BFR93A
1. mixer	ASK-1
1. IF-amplifier	SST310
FM IF-system	SA605D including following functions: 2. local oscillator 2. mixer IF limiter amplifiers quadrature demodulator RSSI (received signal strength indicator)

The receiver is connected to the V701 audio/processor unit with a connector.

ADAPTERS

V701	1	+9 V	receiver operating voltage
	2	RSSI	DC-voltage comparable to field strength (0.5...5 V)
	3	RX-AUDIO	AF-signal for audio unit, approx. 150 mVrms (f.mod 1 kHz dev. 3 kHz)
	4	GND	ground (chassis)

V702:RX-injection 484.400...488.875 MHz +10 dBm/50 ohm.

The receiver RF-signal is brought through the duplex filter NBF40001 to the amplifier stage Q701. The amplifier signal is led the dual balanced mixer X701 through the band filter L703.

The upper injection frequency is brought from the synthesizer unit to the LO input of the mixer through a small resistance attenuator. The IF (intermediate frequency) 21.4 MHz gained in this way is amplified and led through crystal filters X702 and X703 to the FM IF-system IC-circuit (SA605D). The circuit includes another local oscillator, and another mixer.

The second IF is 455 kHz: there is first a 6-pole ceramic filter, and another 4-pole filter in the limiter amplifier chain.

The temperature compensation for the AF-signal indicated has been included in the buffer amplifier stage I702/B.

The temperature compensation for the RSSI signal has been made with the diode pai D701, which is followed by the buffer amplifier I702/A.

The receiver unit gets +9 V regulated operating voltage from the current input unit OW0001 through the audio/processor unit.

The operating voltage is dropped with the transistor Q703 to the lower required by the IF circuit.

7.1 Receiver OR0002 settings

7.1.1 Supply Voltages

A regulated +9 V power supply is fed to the module via connector V701 pin 1.

The intermediate frequency module uses a ca. +6 V supply which can be checked at the solder joint of condenser C727 located on top of the board.

7.1.2 Setting Order:

1. Detector coil V707
2. Crystal filter matching coils L705, L706
3. Helical bandpass filter

1. Adjustment of detector coil L707 is not dependant on the channel used.

Feed a -13 dBm RF-signal to the aerial connector.

Enable RX audio (local 22#).

Connect the local box meter connector to an oscilloscope or AC voltmeter (1 V range).

Adjust coil L707 to maximum value.

NOTE:

(Changing the receiver may cause difference at audio levels. When changing the module, the audio unit RX adjustment should also be checked. If the RX adjustment has been changed, then the FII-deviation must also be checked.)

2. Adjustment of the crystal filter matching coils L705 and L706 is not dependant on the channel used.

Feed a -13 dBm modulated RF-signal to the aerial connector.

Enable RX audio (local 22#).

Connect the local box meter connector to a SINAD meter.

Trim coils L705 and L706 for maximum value on the SINAD meter and repeat the adjustment (35...50 dB SINAD psoph.).

The effect of these coils can be seen even more clearly if the SINAD meter is connected direct to the RX audio output connector V701 pin 3. This simplifies their adjustment.

3. Helical bandpass filter

This adjustment influnces spurious response rejection and tuning must be done carefully using suitable plastic screwdriver, which does not disturb tuning.

Switch on the first channel (local 35#)

Feed to the antenna connector RF-signal at level -93 dBm (463.000 MHz)

Connect DC-voltmeter (analog display) 3 V max connector V701 pin 2 RSSI

Adjust voltmeter to maximum with helix core nearest to the duplexfilter

Change receiver on the highest channel (local 37#) (467.475 MHz)

Adjust voltmeter to maximum value with the other core of the helix

Change back to the first channel

Adjust voltmeter again carefully to maximum value

7.1.3 Check Sensitivities

Channel	RF-input	SINAD psoph.
001	-113 dBm	26...27 dB
180	-113 dBm	26...29 dB (typical values)

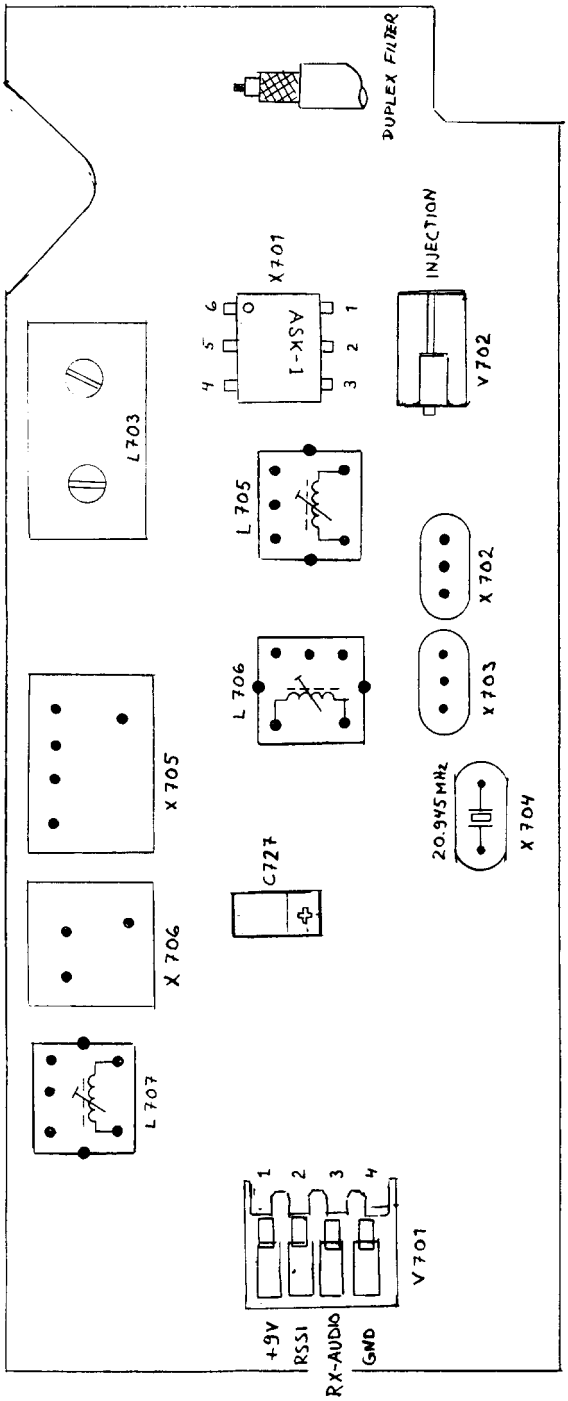
7.1.4 Parts list

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
CC0101	C701	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0471	C702	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0471	C703	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0100	C704	SMD capasitor	10 pF/0.25pF 50 V NP0	Philips	
CC0100	C705	SMD capasitor	10 pF 5% 50V NP0	Philips	
CC0150	C706	SMD capasitor	15 pF 5% 50V NP0	Philips	
CC0101	C707	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0220	C708	SMD capasitor	22 pF 5% 50V NP0	Philips	
CC0103	C709	SMD capasitor	10 nF 10% 50V X7R	Philips	
CD0399	C711	SMD capasitor	3.9pF 0.25 50V NP0	Philips	
CC0220	C712	SMD capasitor	22 pF 5% 50V NP0	Philips	
CC0473	C713	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0390	C714	SMD capasitor	39pF 5% 50V NP0	Philips	
CC0151	C715	SMD capasitor	150 pF 5% 50V NP0	Philips	
CC0473	C716	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C717	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C718	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C719	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0100	C721	SMD capasitor	10 pF/0.25pF 50 V NP0	Philips	
CC0103	C722	SMD capasitor	10 nF 10% 50V X7R	Philips	
CC0473	C724	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C725	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C726	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CU0225	C727	SMD tantal	2.2uF/16V 20% 4.7x2.6mm	Matsushita	ECST1CB 225R
CC0101	C728	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0473	C729	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0331	C730	SMD capasitor	330 pF 5% 50 V NP0	Philips	
CC0101	C731	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0331	C732	SMD capasitor	330 pF 5% 50 V NP0	Philips	
DS0099	D701	SMD diode	70 V 200 mA	Philips	BAV 99
IV6050	I701	FM IF-system		Philips	SA605D
IA0272	I702\	2 x op.amp.	LinCMOS Low noise,power	Texas	TLC27M2ID
LH0465	L703\	Helix filter	450 MHz	Neosid	7.2E 00519630
LC0105	L704	SMD inductor	1.0 uH	Siemens	B82412-A1102-M
LI0225	L705	IF-coil	2.2uH	Toko	5SPN-0225AG 5S
LI0225	L706	IF-coil	2.2uH	Toko	5SPN-0225AG 5S
LI0687	L707	Quad coil	680uH	Toko	7MC-A2549HM 7P
PR0002	PCB	PCB for OR0002	90.5 x 37 x 1.6		Perstorp
QAA093	Q701	SMD transistor	NPN 0.25 W 5 GHz	Philipsa	BFR 93 A
QF0310	Q702	Transistor	N-fet	Siliconix	SST 310
QSB848	Q703	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
RC0472	R701	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0103	R702	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0103	R703	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0221	R704	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0100	R705	SMD resistor	10 R 5% 0.125 W	Kamaya	
RC0120	R706	SMD resistor	12 R 5% 0.125 W	Kamaya	
RC0391	R707	SMD resistor	390 R 5% 0.125 W	Kamaya	
RC0471	R711	SMD resistor	470 R 5% 0.125 W	Kamaya	
RC0222	R712	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0101	R713	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0682	R714	SMD resistor	6.8 k 5% 0.125 W	Kamaya	
RC0223	R715	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0223	R716	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0472	R717	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0471	R718	SMD resistor	470 R 5% 0.125 W	Kamaya	
RC0152	R719	SMD resistor	1.5 k 5% 0.125 W	Kamaya	

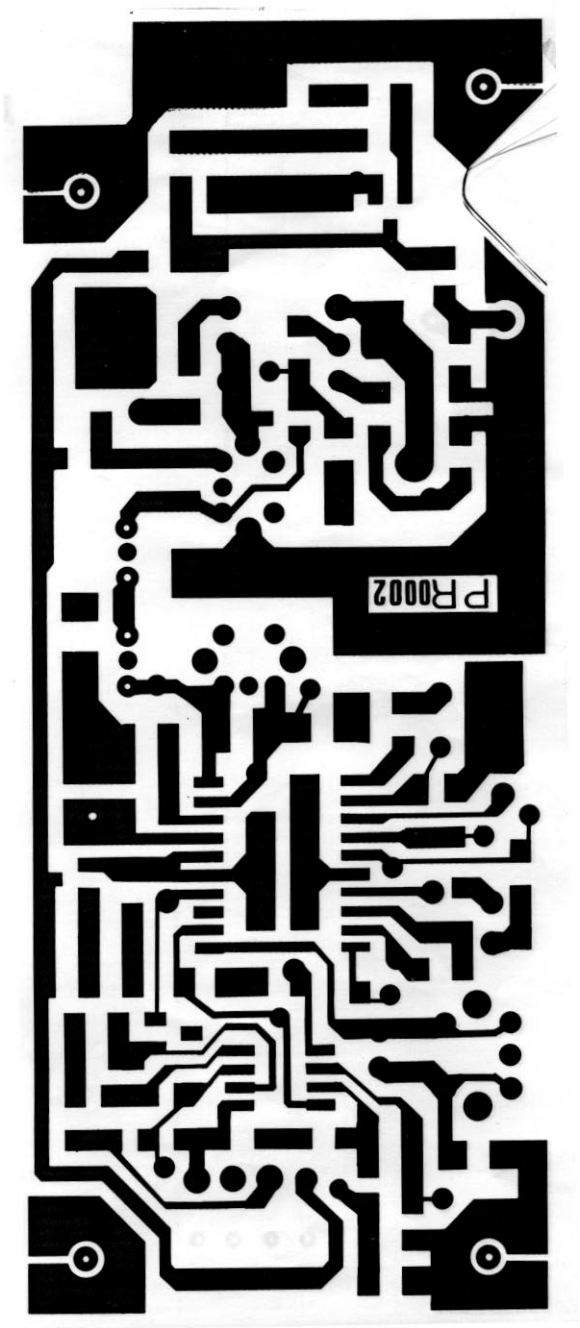
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
RC0473	R720	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0473	R721	SMD resistor	47 k 5% 0.125 W	Kamaya	
RTN223	R722	SMD-NTC resistor	22k 10%	Hokuriku	
RC0273	R723	SMD resistor	27 k 5% 0.125 W	Kamaya	
RC0103	R724	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0104	R725	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0474	R726	SMD resistor	470 k 5% 0.125 W	Kamaya	
RC0473	R727	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0102	R728	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0153	R729	SMD resistor	15 k 5% 0.125 W	Kamaya	
VN0104	V701	4-pin connector		Wisher	WKP-N4B1G-L
VR0135	V702	Coax connector	50 ohm	Taikodenki	TMP-J02X-A1
XM0001	X701	Dual bal. mixer	1-600 MHz	Mini Circ.	ASK-1-X65
XF4214	X702	Crystal filter	4-pole monol 21.4MHz	SUNNY-EMI	
XF4214	X703	Crystal filter	4-pole monol 21.4MHz	SUNNY-EMI	
X20945	X704	Crystal	20.945MHz	Telequarz	HC-45/U-2L
XC6455	X705	Ceramic filter	6-pole 455 kHz	Kyocera	KBF-455R-20A
XC0455	X706	Ceramic Filter	4-pole 455 kHz	Kyocera	KBF-455P-20A

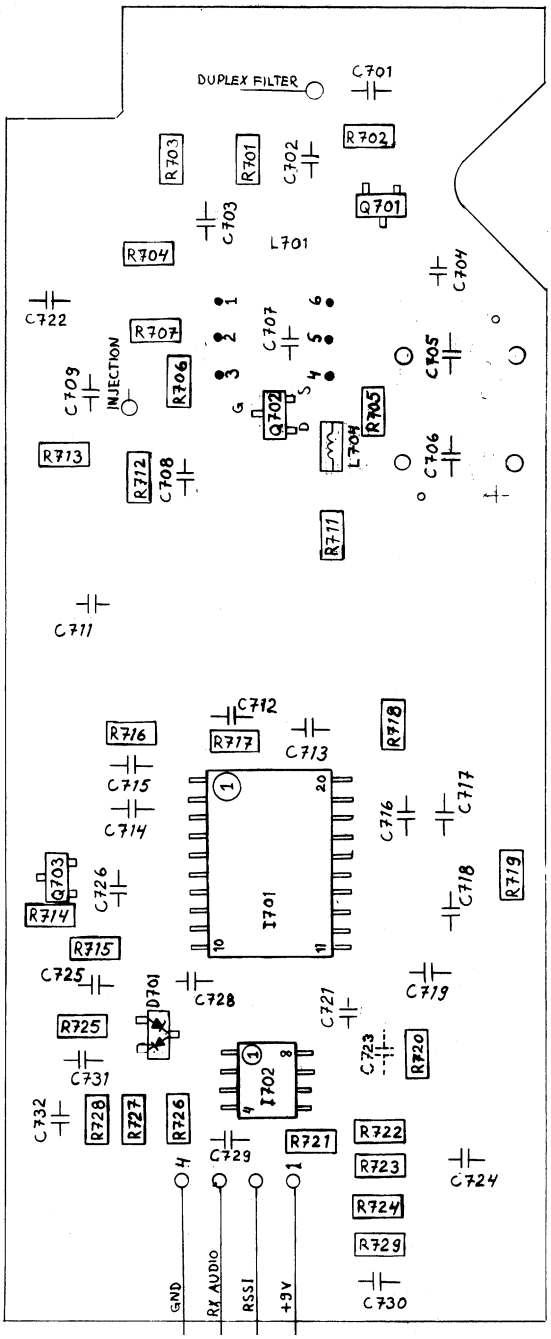
Last
update
14.08.91

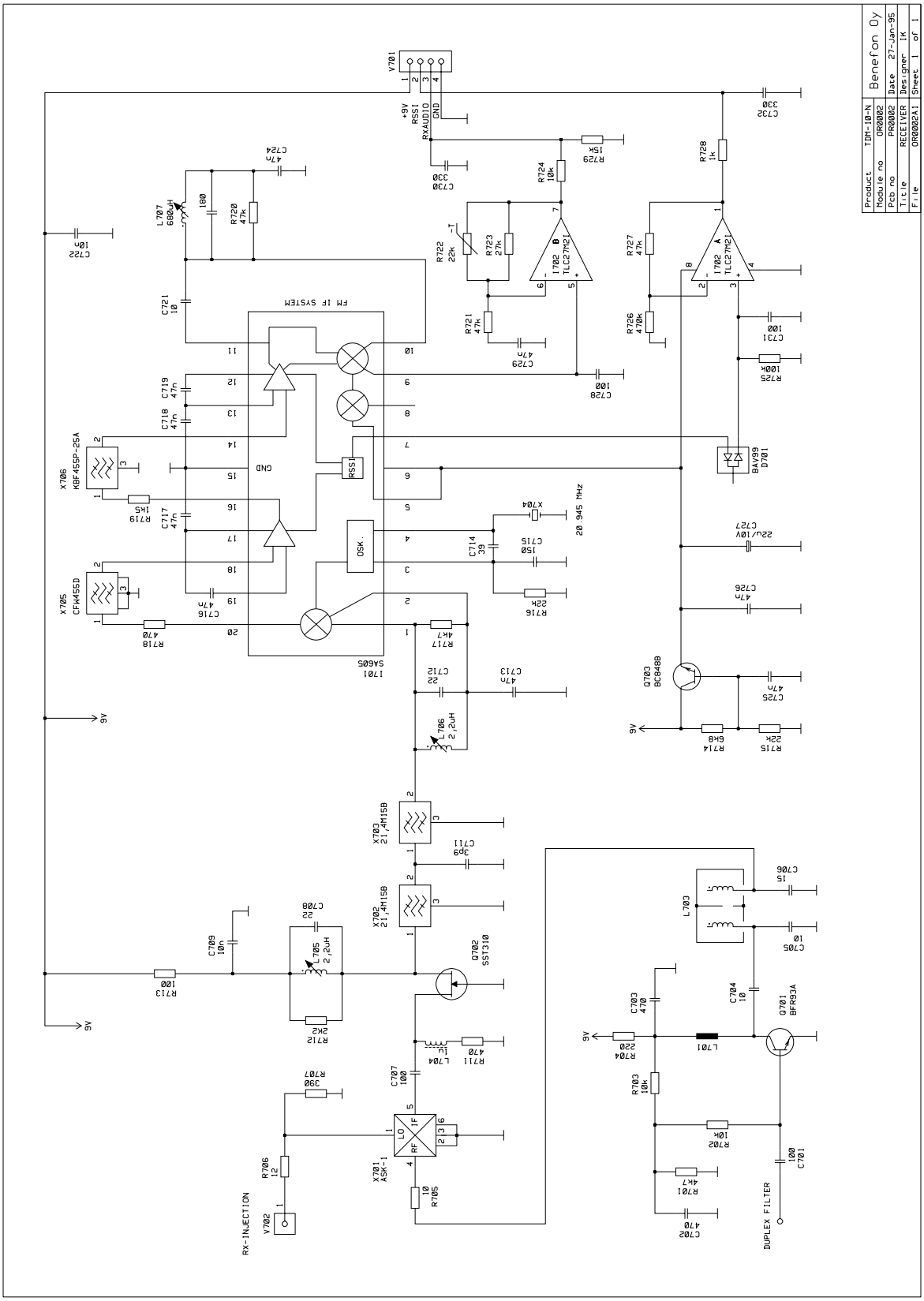
Component Side Layout PR0002A0 (Schematic OR0002A1)



Solder Side Layout PR0002A0 (Schematic OR0002A1)






Benefon Oy
Product TDM-10-N
Module no OR0002
Pcb no PR0002
Title RECEIVER
File OR0002A1
Date 27-Jan-95
Designer IK
Sheet 1 of 1
FM IF SYSTEM
RX-INJECTION
DUPLEX FILTER
+9V
RSSI
RXAUDIO
GND
OSK
ASK-1
20.945 MHz
TLC27M2I
BAV99
BC848B
BFR93A
SST310
SA605
CFW455D
KBF455P-25A

8.0 SYNTHESIZER MODULE OS0021 SPECIFICATIONS

OS0021 Synthesizer

8.0.1 Functions

This unit generates the high frequency signals for respective channel frequencies: this gives a modulated channel-frequency signal for the transmitter unit and upper band injection frequency for the receiver unit.

The synthesizer is connected via connector V401 to the processor/audio unit.

Description of connector V401:

1VB	operating voltage to synthesizer	13.2 V
2 TXAUDIO	tx audio modulation	nominal 550 mV RMS
3 GND	ground(-)	
4 SRE	enable pulse for rx synthesizer IC	5 V
5 STE	enable pulse for tx synthesizer IC	5 V
6 SCLK	clock for rx and tx data	0/5 V
7 SDAT	Arx and tx data for synthesizer IC	0/5 V
8 TXVCO	voltage for tx vco. start-up	5 V
V403	TX-INJECTION MHz +10 dBm/50 ohm	
V402	RX-INJECTION MHz +10 dBm/50 ohm	

8.0.2 Circuit Description

The module can be divided into three main units: TX-synthesizer, RX-synthesizer, and common power supply unit for both synthesizers.

The power supply unit provides stabilized voltages +9 V (TP1) for the high-frequency parts and +5 V (TP2) for the synthesizer and pre-scaler circuits and TCXO. The active components Q401...Q405 are included in the power supply unit.

8.0.3 RX-Synthesizer

Receiver injection frequency is generated by a phase-locked loop (PLL). The coil of the voltage-controlled oscillator is a strip line on the PCB. VCO center frequency is adjusted with trimmer C436. Q411 is the oscillator transistor. Next, there are two amplifier stages Q412 and Q413. The circuit is provided with a 3 dB atttenuator for the outcoming signal, with a part of this signal being fed to the pre-scaler I4022. This is called the dual modulus divider having scaling factors 128/129. The divided frequency is fed to the synthesizer circuit I401.

The synthesizer circuit I401 gets its control signals from the processor unit via connector V401 in serial form. Signal CLK is the clock-frequency for synchronising the transmission of channel-frequency data to the synthesizer. The scaler information is stored by a latch-pulse on SRE bus sent to the synthesizeer circuit.

The divided frequency is compared to the reference frequency with a phase comparator. The exact reference frequency comes from the thermal-compensated crystal CXO). This 12.8 MHz frequency is divided by a factor of 512 in the synthesizer circuit, giving the reference frequency of 25 kHz (= channel space).

The synthesizer is phase-locked when these two frequncies fed to the phase comparator are equal. The phase comparator emits positive pulses in response to low VCO frequency, and ground pulses for high VCO frequency. The phase comparator output chargers and dischargers the capacitor C417 through the resistor R422, while R423 and paralled-connected capacitors C418/419 stabilizing the loop function.

The voltage fed to the above described capacitor is amplified with transistors Q408/409. Two RC-loops R427/C422 and R428/C433 prevent the pulse transfer from the phase comparator to the VCO. The filtered DC voltage alers, when needed, the reversed voltage of the capacitance-diode D403 located in the oscillator circuit, i.e. controls the VCO frequency (TP6).

8.0.4 TX-Synthesizer

TX-frequency is generated with a similar phase-locked loop to the above described Rs-injection frequency.

There are after the VCO three buffer amplifiers Q416, Q417, and Q418. The divider and synthesizer circuits function like the RX-synthesizer. There are common DATA and CLK signals. The scaler information is stored by a latch-pulse on STE bus sent to the synthesizer circuit I403.

TX-synthesizer uses the phase comparator outputs ϕ/R and ϕ/V . This is followed by avtive low-pass filter for control filtering. The VCO control voltage range is widened by raising the filter IC power supply with a voltage converter Q414 (TP7). This filtered control voltage is fed to the capacitance-diode-cathode in the oscillator circuit.

An excessive VCO frequency prompts ϕ /V output-pulses from the phase comparator, but the ϕ /R output will stay in "1"-state. Too low VCO frequency prompts in turn negative O/R output-pulses from the phase comparator, while the O/V output stays in "1"-state.

Modulation is taken from the connector V401 pin 2 (TP5) via level control R459 to the capacitancediode anode of the VCO circuit. With this arrangement the loop filter does not affect the modulation by attenuating the high frequencies.

With low modulation frequencies (300...500 Hz), linear AF-response is maintained by feeding the loop with a "compensation modulation" through the integrator I405. Compensation is adjusted with trimmer R457 so that the AF-response is linear at 300 Hz frequency.

8.1 Synthesizer OS0021 Settings

When measuring, a multimeter with Ri = 10 M ohm has been used.

AC-range 20 Hz...20 kHz.

8.1.1 Checking Operating Voltages

Input operating voltage, connector V401 pin 1 (13.2 V)

+9 V, regulated	TP1	8.6...9.4 V
+5V, regulated	TP2	4.5...5.3 V
+14V	TP7	13...15 V
+TX on	TP3(local 34#)	8.5...9.3 V
+TXoff	TP3(local 34*)	approx 5...7 V

Operating voltages require no adjustment.

+ 9 V accuracy is affected by the Zerner diode V401 (5V6).

Accuracy of this diode is 5% in 0-series. It will be changed to 2% diode. The resistors R408, R409 used for voltage settings have 1% tolerance.

The + 5 V voltage reference is also taken from this 5V6 diode.

8.1.2 RX-VCO Adjustment

Change to lowest channel (local 35#)

Measure voltage TP6, adjust voltage RX-VCO to 3 V with trimmer C436.

Change to highest channel (local 37#)

Check that adjustment voltage is now approx 6 V.

(Synthesizer functions are optimized with above VCO settings-accuracy, channel delay, overlap, channel selectivity).

(VCO-accuracy = voltage difference between end channels)

8.1.3 TX-VCO Adjustment

Switch on TX VCO (local 34#) or transmitter (local 32#)

Change lowest channel (local 35#)

Measure TP4 voltag, and adjust TX-VCO voltage to 5 V with trimmer C498.

Change to highest channel (local 37#)

Check that operating voltage is now approx 7.5...8 V.

The operating voltage range has been raised to 13V. It may be necessary to deviate from the above settings in some production runs in order to ensure linear modulation for end channels.In practice the operating voltage can be between 3V...10V.

8.1.4 Setting Channel Frequency:

8.1.4.1 Measuring Devices:

Frequency counter (resolution 10 Hz)

Switch TX on (local 32#)

Switch to lowest channel (local 35#)

Set correct channel frequency MHz with TCXO trimmer (+/-100 Hz)

8.1.5 Adjusting The Modulation:

Adjust the modulation along wIth the audio unit; see setting instructions for the audio unit, TX-AUDIO.

Set to middle channel (local 36#)

Switch TX on (local 32#) e.g. medium power.

Feed "normal" modulation to microphone input (f mod. 1 kHz 1 Vrms)

Switch microphone off (local 29*)

Switch TX-audio on (local 21#)

Check that TP5 voltage is now 550 mV rms.

Adjust deviation to +/-3 kHz peak with MOD-trimmer R459.

Check deviation of end channels, difference max +/-150 Hz or +/-0.5 dB

8.1.6 Correcting The Low-frequency Response:

Drop mic input level until deviation is +/-1 kHz.

Measure TP5 voltage (reference level).

Change modulation frequency to 300 Hz.

Raise mic input level until TP5 voltage increases to the same level as the reference level.

Adjust deviation to +/-1 kHz with COMP-trimmer R457.

8.1.7 Parts list

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
CC0473	C401	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CE0476	C402	Al elko	47 uF/25 V 7x7mm	Philips	2222 097 56479
CC0102	C403	SMD capasitor	1 nF 5% 50V NP0	Philips	
CU0105	C404	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CE0476	C405	Al elko	47 uF/25 V 7x7mm	Philips	2222 097 56479
CU0105	C407	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0102	C408	SMD capasitor	1 nF 5% 50V NP0	Philips	
CC0473	C409	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0101	C410	SMD capasitor	100 pF 5% 50 V NP0	Philips	
CC0101	C411	SMD capasitor	100 pF 5% 50V NP0	Philips	
CU0105	C412	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0101	C413	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0102	C414	SMD capasitor	1 nF 5% 50V NP0	Philips	
CC0102	C415	SMD capasitor	1 nF 5% 50V NP0	Philips	
CC0473	C416	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0103	C417	SMD capasitor	10 nF 10% 50V X7R	Philips	
CC0473	C418	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C419	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0103	C421	SMD capasitor	10 nF 10% 50V X7R	Philips	
CC0223	C422	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CU0105	C423	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0471	C424	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0569	C425	SMD capasitor	5.6 pF/0.25pF 50 V NP0	Philips	
CD0100	C426	SMD capasitor	10 pF/0.25pF 50 V NP0	Philips	
CD0479	C427	SMD capasitor	4.7 pF/0.25pF 50 V NP0	Philips	
CC0473	C428	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0279	C431	SMD capasitor	2.7 pF/0.25pF 50 V NP0	Philips	
CD0109	C432	SMD capasitor	1 pF/0.25pF 50 V NP0	Philips	
CC0103	C433	SMD capasitor	10 nF 10% 50V X7R	Philips	
CD0689	C434	SMD capasitor	6.8 pF/0.25pF 50 V NP0	Philips	
CA0200	C435	Trim.kond.	5/20 pF	Matsushita	ECRLA020E52V
CC0101	C436	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0471	C437	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0471	C438	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0471	C439	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0100	C441	SMD capasitor	10 pF/0.25pF 50 V NP0	Philips	
CD0569	C442	SMD capasitor	5.6 pF/0.25pF 50 V NP0	Philips	
CC0471	C443	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0829	C444	SMD capasitor	8p2/0.25pF 50V NP0	Philips	
CD0569	C445	SMD capasitor	5.6 pF/0.25pF 50 V NP0	Philips	
CC0101	C460	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0101	C461	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0101	C462	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0103	C463	SMD capasitor	10 nF 10% 50V X7R	Philips	
CE0105	C464	Al elko	1uF/63V 4x7mm	Philips	2222 097 58108
CC0473	C465	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C466	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C467	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CU0105	C468	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CU0105	C469	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0101	C471	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0101	C472	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0473	C473	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0223	C474	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0223	C475	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0101	C476	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0102	C477	SMD capasitor	1 nF 5% 50V NP0	Philips	

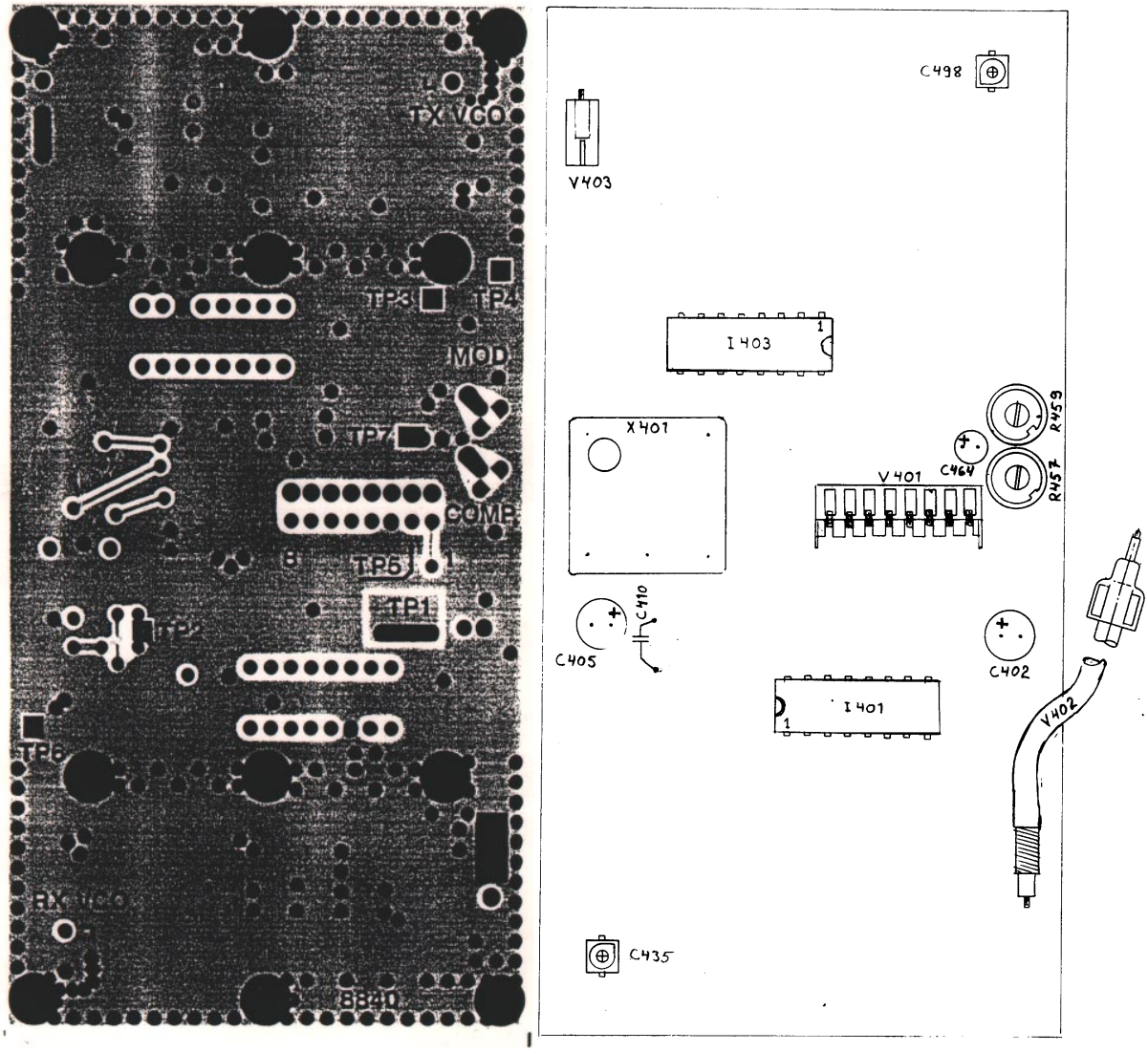
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
CC0102	C478	SMD capasitor	1 nF 5% 50V NP0	Philips	
CC0473	C479	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0472	C481	SMD capasitor	4.7 nF 10% 50 V X7R	Philips	
CC0473	C482	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C483	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0472	C484	SMD capasitor	4.7 nF 10% 50 V X7R	Philips	
CC0473	C485	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0223	C486	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0471	C487	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0473	C488	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CU0105	C489	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CD0100	C491	SMD capasitor	10 pF/0.25pF 50 V NP0	Philips	
CC0150	C492	SMD capasitor	15 pF 5% 50V NP0	Philips	
CD0100	C493	SMD capasitor	10 pF/0.25pF 50 V NP0	Philips	
CC0101	C494	SMD capasitor	100 pF 5% 50V NP0	Philips	
CD0479	C496	SMD capasitor	4.7 pF/0.25pF 50 V NP0	Philips	
CD0829	C497	SMD capasitor	8p2/0.25pF 50V NP0	Philips	
CA0200	C498	Trim.kond.	5/20 pF	Matsushita	ECRLA020E52V
CU0105	C501	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CD0109	C502	SMD capasitor	1 pF/0.25pF 50 V NP0	Philips	
CC0223	C504	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0471	C505	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0471	C506	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0479	C507	SMD capasitor	4.7 pF/0.25pF 50 V NP0	Philips	
CC0471	C508	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0471	C509	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0223	C510	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0150	C511	SMD capasitor	15 pF 5% 50V NP0	Philips	
CD0120	C512	SMD capasitor	12 pF 5% 50 V NP0	Philips	
CC0471	C513	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0120	C515	SMD capasitor	12 pF 5% 50V NP0	Philips	
CC0150	C516	SMD capasitor	15 pF 5% 50V NP0	Philips	
DZ0569	D401	SMD zener	5V6 5% 300mW	Philips	BZX84C5V6
DS0099	D402	SMD diode	70 V 200 mA	Philips	BAV 99
DC0031	D403	Cap.diode	UHF	Philips	BBY 31
DS0099	D404	SMD diode	70 V 200 mA	Philips	BAV 99
DC0031	D405	Cap.diode	UHF	Philips	BBY 31
DC0031	D406	Cap.diode	UHF	Philips	BBY 31
IS5158	I401	PLL freq.synthes.	CMOS	Motorola	MC145158-1P
IS0501	I402	Two mod. prescaler	(2nd MC12022D Motorola)	Fujitsu	MB501LPF
IS5158	I403	PLL freq.synthes.	CMOS	Motorola	MC145158-1P
IS0501	I404	Two mod. prescaler	(2nd MC12022D Motorola)	Fujitsu	MB501LPF
IA0272	I405\	2 x op.amp.	LinCMOS Low noise,power	Texas	TLC27M2ID
LC0334	L401	SMD inductor	330 nH	Siemens	B82412A3331M
LC0334	L402	SMD inductor	330 nH	Siemens	B82412A3331M
LC0334	L403	SMD inductor	330 nH	Siemens	B82412A3331M
LC0334	L408	SMD inductor	330 nH	Siemens	B82412A3331M
LC0334	L409	SMD inductor	330 nH	Siemens	B82412A3331M
LC0334	L412	SMD inductor	330 nH	Siemens	B82412A3331M
PS0001	PCB	Piirilevy OS0001	66 x 130 x 1.6		Perstorp
QS0031	Q401	SMD transistor	PNP 1A/60V	Philips	BSR 31
QSB858	Q402	SMD transistor	PNP 0.1A/30V F<10dB	Philips	BC 858 B
QSB848	Q403	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q404	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q405	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QS0031	Q406	SMD transistor	PNP 1A/60V	Philips	BSR 31
QSB848	Q407	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSC849	Q408	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC859	Q409	SMD transistor	PNP 0.2A/30V F=1.2dB	Philips	BC 859 C
QAA093	Q411	SMD transistor	NPN 0.25 W 5 GHz	Philipsa	BFR 93 A

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
QAA093	Q412	SMD transistor	NPN 0.25 W 5 GHz	Philipsa	BFR 93 A
QAA093	Q413	SMD transistor	NPN 0.25 W 5 GHz	Philipsa	BFR 93 A
QSB848	Q414	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QAA093	Q415	SMD transistor	NPN 0.25 W 5 GHz	Philipsa	BFR 93 A
QAA093	Q416	SMD transistor	NPN 0.25 W 5 GHz	Philipsa	BFR 93 A
QAA093	Q417	SMD transistor	NPN 0.25 W 5 GHz	Philipsa	BFR 93 A
QAA093	Q418	SMD transistor	NPN 0.25 W 5 GHz	Philipsa	BFR 93 A
RC0473	R401	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0102	R402	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0103	R403	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0222	R404	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0472	R405	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0102	R406	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0102	R407	SMD resistor	1 k 5% 0.125 W	Kamaya	
RM1002	R408	Mini-Melf resistor	10k0 1% 0.25W	Beyschlag	MMA 0204-50
RM5621	R409	Mini-Melf resistor	5k62 1% 0.25W	Beyschlag	MMA 0204-50
RC0101	R411	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0101	R412	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0104	R413	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0331	R414	SMD resistor	330 R 5% 0.125 W	Kamaya	
RC0472	R415	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0104	R416	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R417	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0100	R418	SMD resistor	10 R 5% 0.125 W	Kamaya	
RC0102	R419	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0222	R420	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0100	R421	SMD resistor	10 R 5% 0.125 W	Kamaya	
RC0822	R422	SMD resistor	8.2 k 5% 0.125 W	Kamaya	
RC0223	R423	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0473	R424	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0472	R425	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0332	R426	SMD resistor	3.3 k 5% 0.125 W	Kamaya	
RC0472	R427	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0103	R428	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0101	R431	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0101	R432	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0153	R433	SMD resistor	15 k 5% 0.125 W	Kamaya	
RC0472	R434	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0101	R435	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0332	R436	SMD resistor	3.3 k 5% 0.125 W	Kamaya	
RC0221	R437	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0223	R438	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0102	R439	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0562	R441	SMD resistor	5.6 k 5% 0.125 W	Kamaya	
RC0221	R442	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0223	R443	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0471	R444	SMD resistor	470 R 5% 0.125 W	Kamaya	
RC0560	R445	SMD resistor	56 R 5% 0.125 W	Kamaya	
RC0221	R446	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0180	R447	SMD resistor	18 R 5% 0.125 W	Kamaya	
RC0271	R448	SMD resistor	270 R 5% 0.125 W	Kamaya	
RC0473	R451	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0102	R452	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0105	R453	SMD resistor	1 M 5% 0.125 W	Kamaya	
RC0473	R454	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0473	R455	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0224	R456	SMD resistor	220 k 5% 0.125 W	Kamaya	
RQ0103	R457	Trimmer resistor	10k 20% 0.5W	Bourns	3329H-1-103
RC0222	R458	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RQ0103	R459	Trimmer resistor	10k 20% 0.5W	Bourns	3329H-1-103

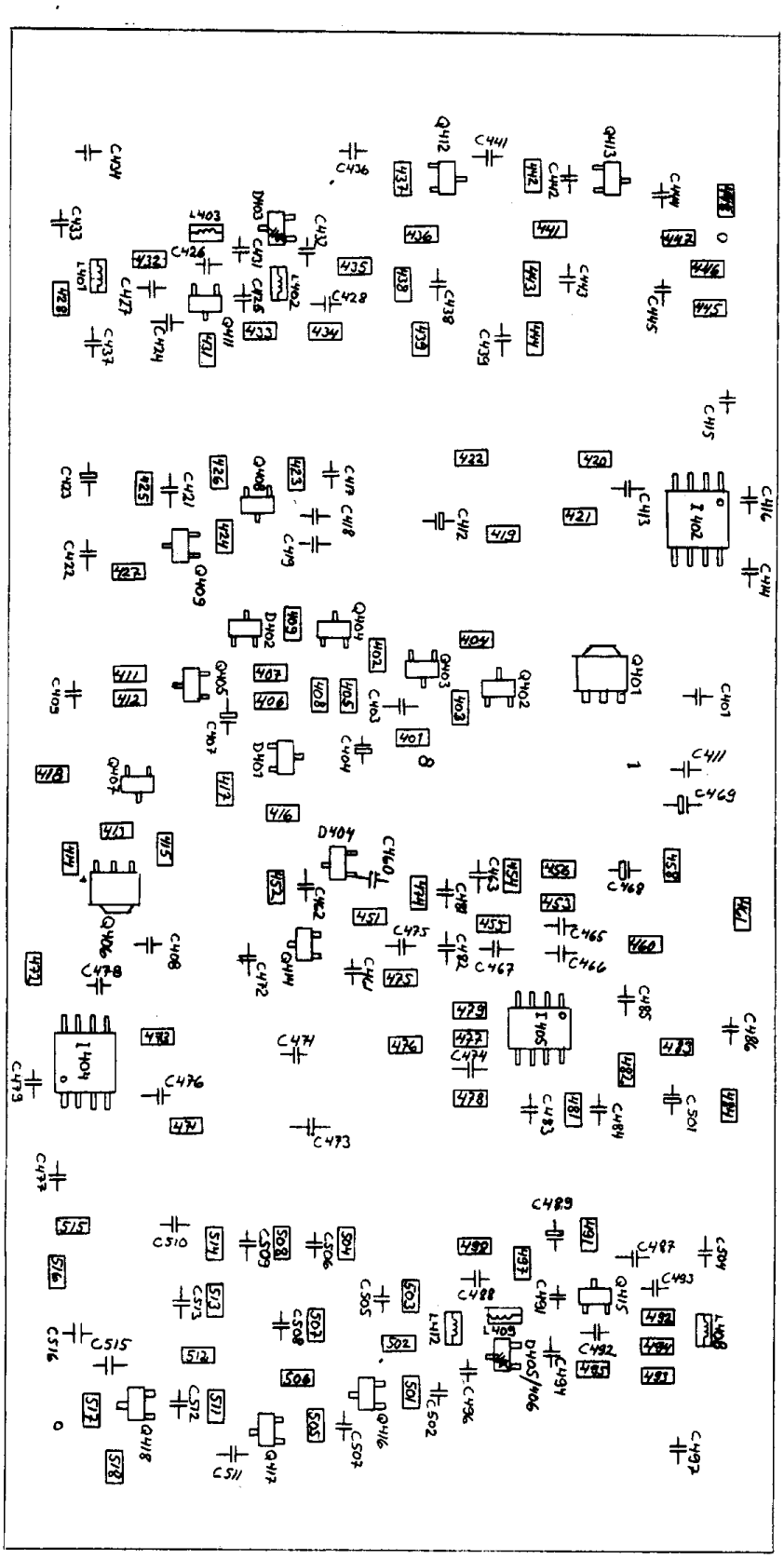
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
RC0222	R460	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0103	R461	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0222	R471	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0100	R472	SMD resistor	10 R 5% 0.125 W	Kamaya	
RC0102	R473	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0473	R474	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0472	R475	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0472	R476	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0223	R477	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0223	R478	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0104	R479	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0473	R481	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0222	R482	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0222	R483	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0222	R484	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0101	R491	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0101	R492	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0472	R493	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0560	R494	SMD resistor	56 R 5% 0.125 W	Kamaya	
RC0103	R495	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0153	R497	SMD resistor	15 k 5% 0.125 W	Kamaya	
RC0472	R498	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0102	R501	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0332	R502	SMD resistor	3.3 k 5% 0.125 W	Kamaya	
RC0223	R503	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0102	R504	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0221	R505	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0562	R506	SMD resistor	5.6 k 5% 0.125 W	Kamaya	
RC0223	R507	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0471	R508	SMD resistor	470 R 5% 0.125 W	Kamaya	
RC0221	R511	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0562	R512	SMD resistor	5.6 k 5% 0.125 W	Kamaya	
RC0223	R513	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0331	R514	SMD resistor	330 R 5% 0.125 W	Kamaya	
RC0680	R515	SMD resistor	68 R 5% 0.125 W	Kamaya	
RC0121	R516	SMD resistor	120 R 5% 0.125 W	Kamaya	
RC0270	R517	SMD resistor	27 R 5% 0.125 W	Kamaya	
RC0181	R518	SMD resistor	180 R 5% 0.125 W	Kamaya	
VN0108	V401	8-pin connector		Wisher	WKP-N8B1G-L
VR0235	V402	Coax cable + connector	50 ohm l=n.70mm	Taikodenki	TMP-P01X-A1
VR0135	V403	Coax connector	50 ohm	Taikodenki	TMP-J02X-A1
XO0128	X401	TCXO	12.8 MHz 2 ppm	Toyocom	TCO-903B1

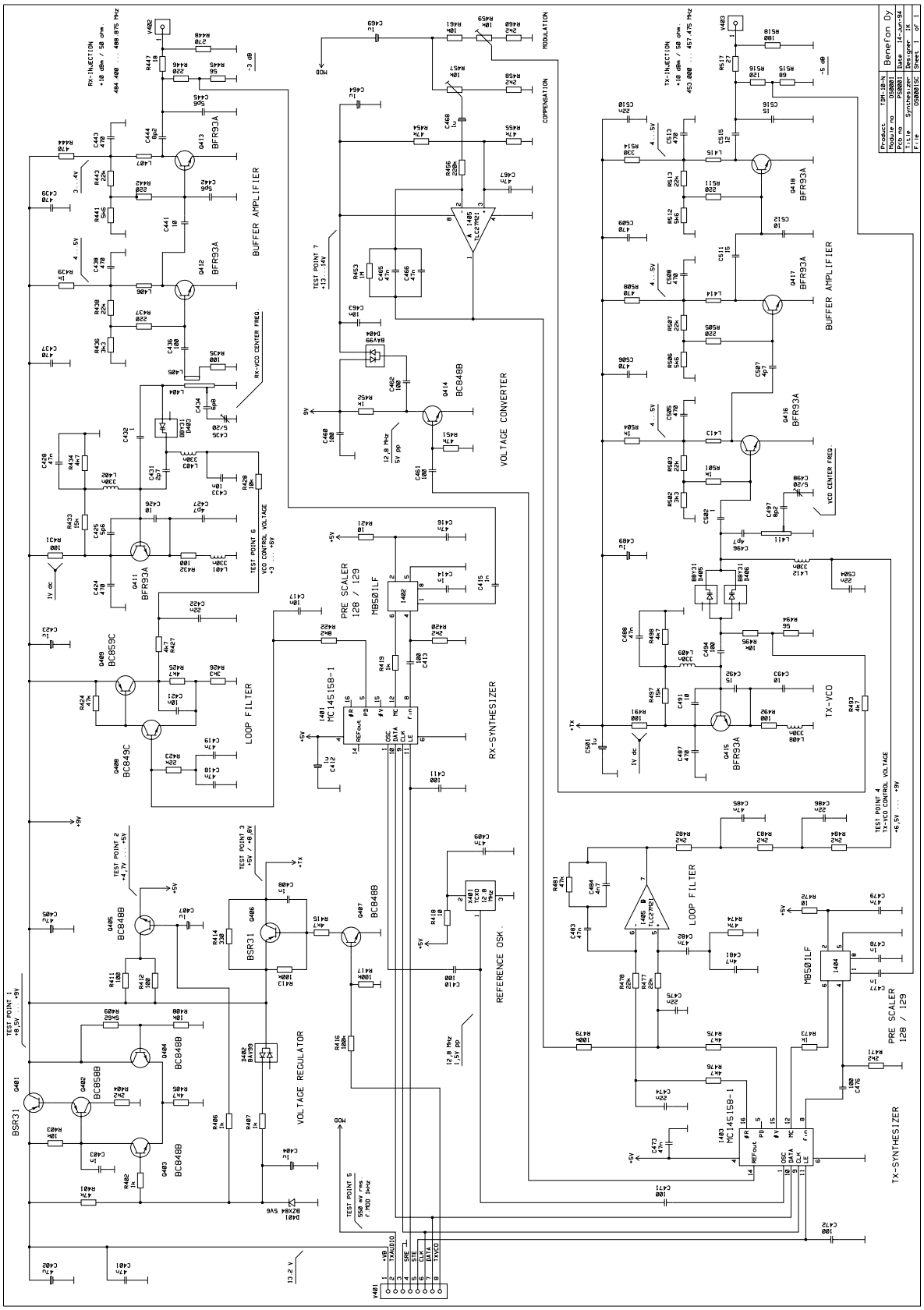
Last update 13.03.90

Component Side Layout PS0001A0 (Schematic OS0001A0)



Solder Side Layout PS0001A0 (Schematic OS0001A0)




RX-INJECTION
TX-INJECTION
BUFFER AMPLIFIER
VOLTAGE CONVERTER
LOOP FILTER
RX-SYNTHESIZER
TX-VCO
REFERENCE OSK.
VOLTAGE REGULATOR
PRE SCALER 128 / 129
MB501LF
MC145158-1
TX-SYNTHESIZER
MODULATION
COMPENSATION
VCO CONTROL VOLTAGE
RX-VCO CENTER FREQ.
VCO CENTER FREQ
TEST POINT 1
TEST POINT 2
TEST POINT 3
TEST POINT 4
TEST POINT 5
TEST POINT 6
TEST POINT 7
Benefon Oy
TDM-20-N
OS0021
14-Jun-94

9.0 POWER SUPPLY MODULE OW0002 SPECIFICATIONS

OW0002 Power supply

P.S.U. includes noise filter, 9 V-regulator, speaker amplifier, and relay drivers.

9.0.1 Connector X800

1	MUTE	CAR RADIO MUTE relay-driver 0.5A		
2	IGS	IGNITION SENSE		
3	GND	GROUND		
4	AL	EXTERNAL ALARM relay-driver 0.5A		
5	SPKR	SPEAKER	4...8 ohm	
6	VB	SUPPLY VOLTAGE	10.8...15.6 V	5 A

9.0.2 Connector X820

1	12 V	12V for processor module		
2	9 V	9 V regulator	8.5...9 V	1 A
3	BCUP	BACK-UP power supply for RAM-memory		
4	PWR	ON/OFF control		
5	AFIN	audio input for speaker amplifier		
6	IGN	IGNITION control		
7	EXAL	EXTERNAL ALARM control		
8	EXMUTE	CAR RADIO MUTE control		

9.0.3 Connector X830

1	+TX	SUPPLY VOLTAGE FOR TRANSMITTER

9.0.4 Operation Principles:

Noise from vehicle electrical-system is filtered with low-pass filter C810, C811, L810, C813, C812, L811, and zenerdiode D812. Main relay A800 in driven from connector X820/4(5 V). The speaker must be connected to X800/5, or otherwise transistor Q813 conducts and cannot swich the power ON. D811, D814, and transistor Q810 prevent switching power ON when supply voltage is too high.

The output voltage of the regulator is set by R806, R807, and zenerdiode D800, and current limit by R803.

Speaker amplifier is in stand-by position (low current-consumption) when there is no blas voltage in connector X820/5.

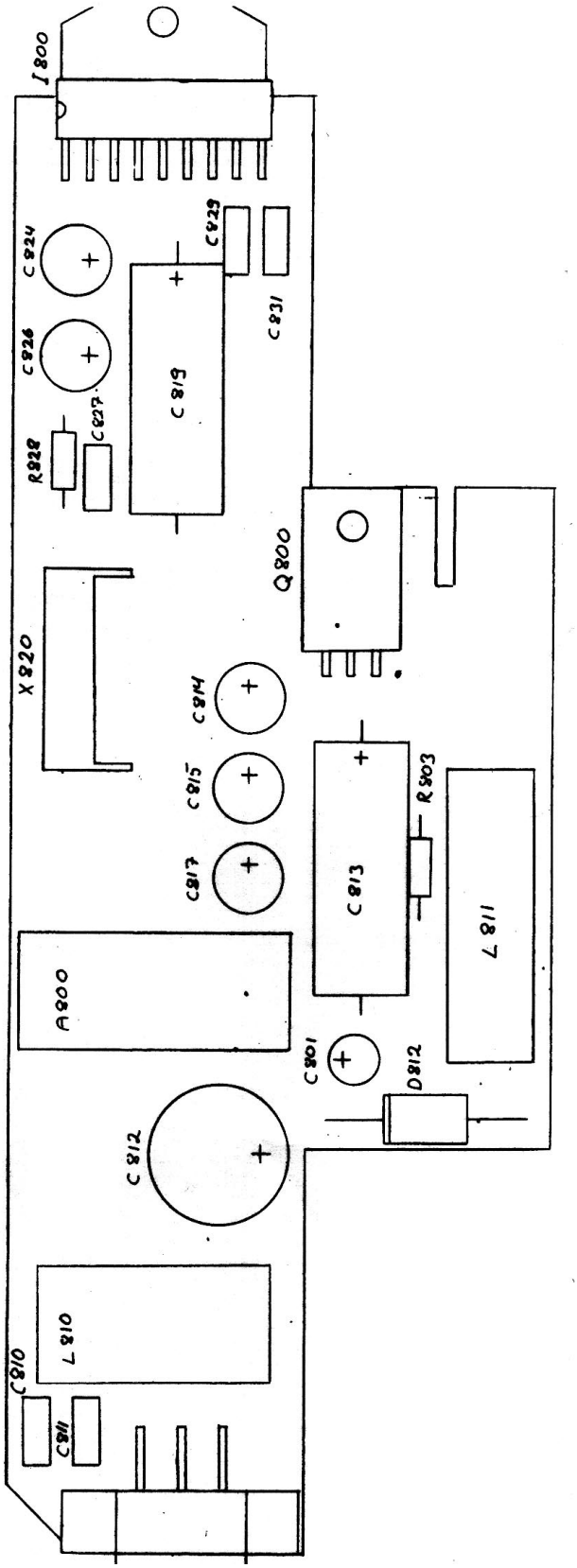
9.0.5 Parts list

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
AR0002	A800\	Relay	12V/10A	Guardian	1655S-IC-12D
CC0473	C800	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CE0106	C801	Al elko	10 uF/35 V 5x7mm	Philips	2222 097 50109
CC0222	C802	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CC0473	C803	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CP0104	C810	Polyester cap	100n 63V 20%	Wima	
CP0104	C811	Polyester cap	100n 63V 20%	Wima	
CE0228	C812	Al elko	2200 uF/25 V 16x25	Elna	RE2-25V222M
CE0477	C813	Al elko	470 uF/25 V 10x25mm	ROE	EB00GD347E00R
CE0107	C814	Al elko	100uF 16V 7x7mm	Philips	2222 097 55101
CE0476	C815	Al elko	47 uF/25 V 7x7mm	Philips	2222 097 56479
CC0473	C816	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CE0107	C817	Al elko	100uF 16V 7x7mm	Philips	2222 097 55101
CC0222	C818	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CE0477	C819	Al elko	470 uF/25 V 10x25mm	ROE	EB00GD347E00R
CC0222	C820	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CC0222	C821	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CC0222	C822	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CC0222	C823	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CE0476	C824	Al elko	47 uF/25 V 7x7mm	Philips	2222 097 56479
CC0473	C825	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CE0107	C826	Al elko	100uF 16V 7x7mm	Philips	2222 097 55101
CP0104	C827	Polyester cap	100n 63V 20%	Wima	
CC0222	C828	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CP0104	C829	Polyester cap	100n 63V 20%	Wima	
CC0473	C830	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CP0104	C831	Polyester cap	100n 63V 20%	Wima	
CC0222	C832	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CC0223	C833	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0473	C834	SMD capasitor	47 nF 10% 50 V X7R	Philips	
DZ1569	D800	SMD zener	5V6 2% 300mW	Philips	BZX84B5V6
DS0070	D801	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DS0017	D810	SMD diode	1.5A/400V	Philips	BYD 17 G
DS0017	D811	SMD diode	1.5A/400V	Philips	BYD 17 G
DT0018	D812	Transient filter	18V/50A 1500W	Motorola	ICTE-18
DS0017	D813	SMD diode	1.5A/400V	Philips	BYD 17 G
DZ0180	D814	SMD zener	18V 5% 300mW	Philips	BZX84C18
DS0070	D815	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DS0017	D816	SMD diode	1.5A/400V	Philips	BYD 17 G
DS0017	D817	SMD diode	1.5A/400V	Philips	BYD 17 G
IA1020	I800	Audio power amplifier	7W/14.4V/4ohm	Philips	TDA1020/N4
LA5107	L810	Inductor	100uH 5A	Fuji	SL05B101
VI0040	MEK1	Component base	1 base = 40 holes	Perlos	
VI0040	MEK2	Component base	1 base = 40 holes	Perlos	
VI0040	MEK3	Component base	1 base = 40 holes	Perlos	
VI0040	MEK4	Component base	1 base = 40 holes	Perlos	
VI0040	MEK5	Component base	1 base = 40 holes	Perlos	
VI0040	MEK6	Component base	1 base = 40 holes	Perlos	
PW0002	PCB	PCB for OW0002	149 x 56 x 1.6mm FR4		
QP0032	Q800	Power transistor	PNP 3A/60V	Philips	BDT 32 AF
QS0051	Q801	SMD transistor	PNP 1.5A/45V	Philips	BCX 51
QSB848	Q802	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q803	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q810	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q811	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QS0054	Q812	SMD transistor	NPN 1.5A/45V	Philips	BCX 54
QSB848	Q813	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B

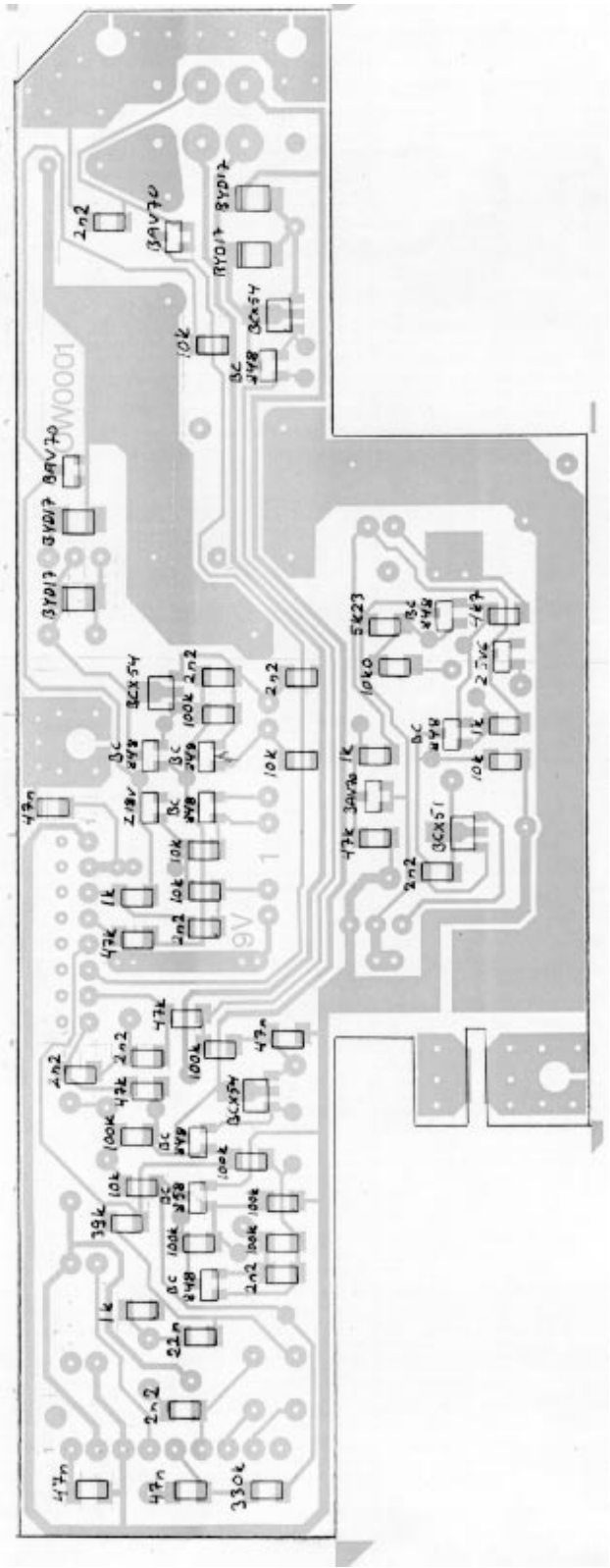
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
QS0054	Q814	SMD transistor	NPN 1.5A/45V	Philips	BCX 54
QSB848	Q815	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QS0054	Q816	SMD transistor	NPN 1.5A/45V	Philips	BCX 54
QSB848	Q817	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q818	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB858	Q819	SMD transistor	PNP 0.1A/30V F<10dB	Philips	BC 858 B
RC0473	R800	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0102	R801	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0103	R802	SMD resistor	10 k 5% 0.125 W	Kamaya	
RA0681	R803	Metal film resistor	680R 5% 0.25 W	Philips	
RC0472	R804	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0102	R805	SMD resistor	1 k 5% 0.125 W	Kamaya	
RM6041	R806	Mini-Melf resistor	6k04 1% 0.25W	Beyschlag	MMA 0204-50
RM1002	R807	Mini-Melf resistor	10k0 1% 0.25W	Beyschlag	MMA 0204-50
RC0330	R810	SMD resistor	33 R 5% 0.125 W	Kamaya	
RC0103	R812	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0103	R813	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0103	R814	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0103	R815	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0104	R816	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0473	R817	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0473	R818	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0104	R819	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0473	R820	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0104	R821	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R824	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0334	R825	SMD resistor	330 k 5% 0.125 W	Kamaya	
RC0104	R826	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R827	SMD resistor	100 k 5% 0.125 W	Kamaya	
RA0479	R828	Metal film resistor	4R7 5% 0.25 W	Philips	
RC0103	R829	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0104	R830	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0393	R831	SMD resistor	39 k 5% 0.125 W	Kamaya	
RC0102	R832	SMD resistor	1 k 5% 0.125 W	Kamaya	
VW0106	X800	Connector	male 6-pin	Molex	5569-06-A1
VN0208	X820	8-pin connector		Wisher	WKP-N8SG-L

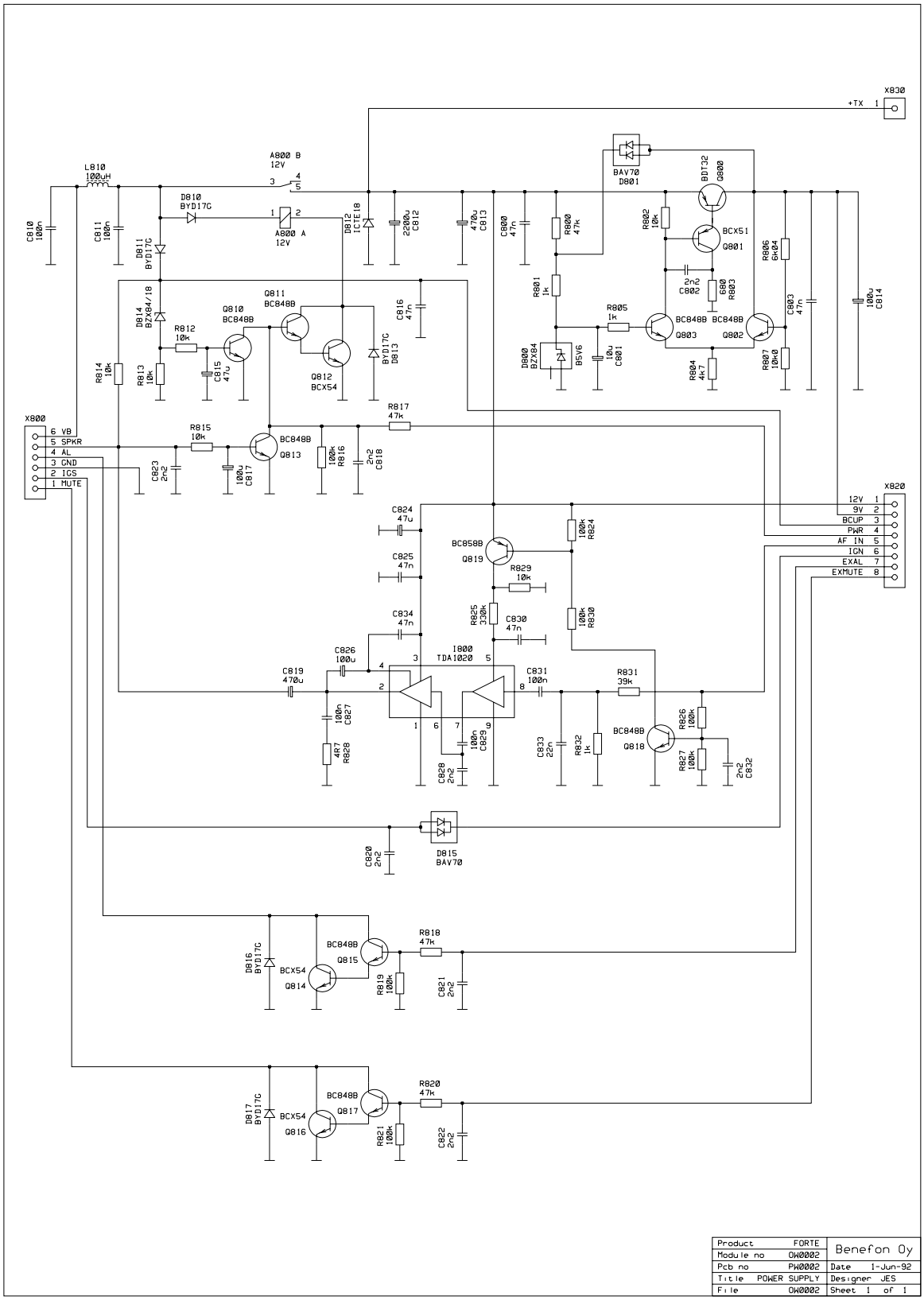
Last
update
21.04.94

Component Side Layout PW0002A0 (Schematic OW0002A0)



Solder Side Layout PW0002A0 (Schematic OW0002A0)




X830
+TX 1
L810 100uH
A800 B 12V
A800 A 12V
D810 BYD17G
D811 BYD17G
D812 1CTE18
C810 100n
C811 100n
C812 2200u
C813 470u
C800 47n
R800 47k
BAV70 D801
BD132 Q800
BCX51 Q801
R802 10k
R806 6k04
C802 2n2
R803 680
R801 1k
R805 1k
BC848B Q803
BC848B Q802
C803 47n
C814 100u
D808 BZX84
B5V6
C801 10u
R804 4k7
R807 10k0
D814 BZX84/18
Q810 BC848B
Q811 BC848B
Q812 BCX54
R812 10k
C815 47u
C816 47n
D813 BYD17G
R814 10k
R813 10k
X800
6 VB
5 SPKR
4 AL
3 GND
2 IGS
1 MUTE
R815 10k
BC848B Q813
R817 47k
R816 100k
C818 2n2
C823 2n2
C817 100u
X820
12V 1
9V 2
BCUP 3
PWR 4
AF IN 5
IGN 6
EXAL 7
EXMUTE 8
C824 47u
C825 47n
C834 47n
BC858B Q819
R824 100k
R829 10k
R825 330k
C830 47n
R830 100k
I800 TDA1020
C826 100u
C819 470u
C827 100n
R828 4R7
C828 2n2
C829 100n
C831 100n
R831 39k
C833 22n
R832 1k
BC848B Q818
R826 100k
R827 100k
C832 2n2
C820 22
D815 BAV70
D816 BYD17G
BC848B Q815
BCX54 Q814
R818 47k
R819 100k
C821 2n2
D817 BYD17G
BC848B Q817
BCX54 Q816
R820 47k
R821 100k
C822 2n2
Product FORTE
Module no OW0002
Pcb no PW0002
Title POWER SUPPLY
File OW0002
Benefon Oy
Date 1-Jun-92
Designer JES
Sheet 1 of 1

10.0 AUDIO

Audio

10.0.1 Principles Of Audio Operation

Audio is split into three sections, according to part-numbers:

TX-AUDIO	parts 200 ... 289
Regulator	parts 290 ... 299
RX-AUDIO	parts 300 ... 399

10.0.2 TX-Audio

I382 works as input buffer and attenuator and band-pass-filter (300 Hz...3.4 kHz).

I220 and I384D control the microphone line VOL in VOX mode (range c.20 dB), and function as two-step limiters (c. 1 dB, 3 dB) in normal use. Yhe circuits combine the TXAUXOUT and DTMFTX signals too.

I210A act as MICDET AC/DC conventer.

I384C act as dynamic compressor which is passed-by I390B.

C234 and R234 set a 6 dB pre-emph, and I235A act as amplifier.

I235B form a first maximum deviation limiter.

I382D form a second limiter and a low-pass-filter with the cut-off frequency of 3.4 kHz.

I382E act as the band-pass-filter of FII signal.

I210B combines FII and FFSKT signals, which are fed through the TXAUDIO line to the synthesizer.

VR is modulated to VFF-voltage for I205C modem connection.

10.0.3 RX-Audio

I382 serves as an amplifier for reciever signals, or an attenuator in AUDLOOPON mode. From I382F the FII signal branches to TXAUDIO. In the other branch, I382F filters audio signal (300 Hz...3,4 kHz) and forms a 6 dB de-emph.

I384E works as an attenuator to expandor which is passed-by I390C.

I321A act as ERPDET AC/DC converter.

I361 and I321 together give VOL-control on SPK-line (control range +15...-10 dB), and also combine DTMF signals. The control is also used in VOX mode. VPS is modulated to VDref-half-voltage for I321B.

Half-voltage goes also to DTMF switch I305A.

I331 and I342A together give VOL-control on ERP-line (control rante +15 dB...-10 dB).

I342 is an amplifier for the system-cable.

10.0.4 Regulator

I380 regulate 9 V to 5 V (VR). Q295 switch on VPS-voltage to the audio parts.

The processor provides 4 MHz clock frequency for the CMOS switched capasitor filter of which parts B, D, E and F are filters and A generates half-voltage Vbias.

I384A generates half-voltages Vref and VTref. B part is an expandor, C part is an compressor and D and E parts are amplifiers.

10.0.5 Audio

10.0.5.1 Logic Control

MICVOL: 2		microphone VOL-control (0,1,2)
TXAUDCONT:	3	TX logic control
	- AUXOFF	accessory bypass
	- TXAON	TX audio ON
	- FFSKT	modem ON
	- DTMFON	DTMF ON
ERPVOL: 2		erp/spk VOL control (0,1,2)
RXAUDCONT: 7		RX logic control
	- FIILOOP	ON (FII signal loop ON)
	- AUDILOOP	audioloop from TX to RX (test)
	- RXAON	RX-AUDIO ON
	- ERPON	handset ON
	- SPKON	speaker ON
	- HIDTMFON	hi DTMF level ON
	- COMPOFF	compandor OFF
	- AUDIOPWR	audio power amplifier ON
	-DTMFRXON	DTMF to speaker ON

10.0.6 Audio Input Signals

(ac-values 3 kHz deviation, 1 kHz signal)

MIC	microphone signal (+PWRSW-signal)	1 VRMS
SO	modem signal	775 mVRMS
TXAOUT	accessory to transmitter	400 mVRMS
RXAOUT	accessory to erp/speaker	400 mVRMS
DTMFTX	DTMF generator to TX and speaker	150 mVRMS
RXAUDIO	receiver to audio	c.120 VRMS
4 MHz	4 MHz clock to audio-filter circuit	

10.0.7 Audio Output Signals

(ac-values 3 kHz deviation, 1 kHz signal)

MICDET	microphone DC-signal level to processor AD converter	0...8 VDC
PWRSW	PWR-switch signal	5/0 VDC
TXAUXIN	microphone to aux	400 mVRMS
RXAUXIN	receiver to aux	300 mVRMS
TXAUDIO	audio to synthesizer	550 mVRMS
ERPDET	receiver DC-signal level to processor AD converter	0...8 VDC
DTMFRX	DTMF-signals from receiver to DTMF receiver	400 mVRMS
SPK	audio output to speaker (+15...-10 dB)	120 mVRMS (VOL 0 dB)
ERP	audio output to handset (+15...-10 dB) (+ HOOK-signal)	300 mVRMS (VOL 0 dB)
FFSKR	modem signal	400 mVRMS
HOOK	HOOK-signal from handset	5/0 mVRMS

10.0.7.1 Operating Voltages In Audio

9V	supply voltage from OW-module	9V
VR	constant voltage in audio (regulated)	5V
VPS	interrupt voltage in audio (regulated)	5V
VTREF	TX half-voltage	2.5V
VFF	DC bias to modem	1.5V
VREF	RX half-voltage (interrupted)	2.5V
VDREF	RX half-voltage (interrupted)	2.5V
Vbias	RX/TX half-voltage (continuous)	2.5V

10.0.8 Audio Settings

Measurements must be made with a multimeter of 10 Mohm resistance. AC range of meter should be 20 Hz... 20 kHz. LOCAL-BOX must be used when making adjustments.

10.0.9 Operating Voltages

9V	X-PWR	pin 2	9V
VR	I380	pin 1	4.8 ... 5.1 V
Vbias	I382	pin 7	2.4 ... 2.55 V
Vref	I384	pin 8	2.35 ... 2.5 V
VPS	I384	pin 20	4.7 ... 5.0 V
VTref	I384	pin 8	2.35 ... 2.5 V
VFF	I205	pin 9	1.4 ... 1.6 V
VDref	I321	pin 5	2.35...2.5 V

10.0.10 RX Audio

RF-generator settings:

- frequency 465.225 MHz
- rf-level 60 dBuV
- modulation frequency 1 kHz
- deviation 3 kHz

Local-box switches set to SERVICE and RADIO

Set mid-channel (local 36#)

By-pass compandor (local 200*, COMPOFF).

Turn on RX-audio (local 22# RXA ON , local 200# EXP ON). DO NO TOUCH VOL-control during setting operation.

RX-audio level is set with 300 mVRMS trimmer R302 (RX) and is measured at the local-box METER-connector.

Reset (local 0#).

10.0.11 TX-Audio

10.0.11.1 Normal Deviation:

- Local-box switches set to SERVICE and RADIO.
- Turn to TX-audio (local 21#, TXA ON).
- By-pass compandor (local 200*, COMPOFF)
- Feed a 1 kHz, 1 VRMS signal from a AF-generator to the local-box GEN connector.
- Connect multimeter to X-SYNTE, pin 2, and adjust trimmer R241 (TX) to show 550 mVRMS.
- Switch on transmitter to medium power (LOCAL 32#, M TXON) on mid-channel (local 36#, MIDLEC).
- Adjust deviation with trimmer R459 (MOD; OS-module) to +/-3 kHz peak.
- Drop AF-generator level until deviation is +/-1 kHz and measure comparative level at X-SYNTE, pin 2.
- Change AF-generator frequency to 300 Hz.
- Raise pt-generator level until meter level showe the previous comparative level.
- Adjust the deviation with trimmer R457 (COMP., OS-module) to +/-1 kHz.

10.0.12 Maximum Deviation

- Change AF-generator frequency to 1 kHz.
- Raise AF-generator level to 3.33 Vrms
- Compare channels 0,90 and 180 in turn, and check that max. deviation is +/-4.5 kHz. If deviation exceeds 4.5 kHz then adjust with trimmer R244 to max. 4.45 kHz.

10.0.13 FFSKT Deviation

- Switch to medium power (local 32#, M TXON).
- Turn FFSKT on (local 12#, SEND 0).
- Adjust deviation with trimmer R265 (FFSKT) to +/-4.2 kHz.
- Reset (local 0#).

10.0.14 FII Deviation, Method 1

RF-generator settings:

- frequency 465.225 MHz (mid-channel)
- RF-level 60 dBuV
- modulation frequency 4 kHz
- deviation 600 Hz

Open FII-LOOP (local 23#, FII ON).

Medium-power ON (local 32#, MTXON)

Adjust devialtion with trimmer R255 (FII) to +/-670 Hz

FII-limits 610...730 Hz

Reset (local 0#).

10.0.15 FII Deviation, Method 2

(not recommendable)

- Set phone to NMT-mode
- Set CMT to mid-channel
- Make a call with CMT
- Set handset to MUTED-mode
- Find "PASS SUP. TONE" from CMT
- Set CMT-deviation frequency to 0 Hz
- Adjust deviation with trimmer R255 (FII) to +/-650 Hz
- FII-limits 590...710 Hz
- End call

10.0.16 Limiter Adjustment

- Local-box switches set to SERVICE and RADIO
- Turn on TX-audio (local 21#, TXA ON)
- Switch to medium power (local 32#, MTXON)
- Feed a 1 kHz, 1 VRMS signal from a AF-generator to the local-box GEN connector
- Indicated deviation should be +/-3 kHz
- Set to adjust-mode (local 39#, DEV LO)
- Raise AF-generator level until deviation reading is +/-3.4 kHz; handset reading should be c. 80...90 (AD-converter value)
- Press OK (first limiter-level set to EEPROM memory); "DEV HI" on display
- Raise pt-generator level until deviation is +/-4.15 kHz
- Press OK (second limiter level stored to EEPROM)
- Should the maximum deviation remain below +/-4.15 kHz, set the second limiter level to AD-converter value 145 (display shows DEV HI)
- Limiter settings can be checked with local 39*, DEVLIM.

10.0.17 Deviation Limiter

There is an SW controlled deviation limiter in the phone. The purpose of the deviation limiter is to compress microphone levels which causes maximum deviation and distortion to transmitted voice.

Deviation limiter is tuned during manufacturing.

There are two thresholds in the limiter. When microphone signal is above tuned threshold the limiter attenuates it. Attenuation is 0.8 dB when microphone signal is above the first threshold and 2.7 dB when above the second.

10.0.18 Voice Operated HF

10.0.18.1 General:

Voice operated HF software uses microphone and speaker level detectors to measure, and TX and RX attenuators to set the microphone and speaker signals.

Voice operated HF is designed in such a way that a detected microphone signal above tuned HF threshold always attenuates the speaker signal.

Microphone threshold is tuned in LOCAL by installer to work properly in the vehicle where the phone is used.

10.0.18.2 Seesaw Model Of The Voice Operated HF

1. When microphone signal rises above tuned threshold the TX attenuation is decreased and RX attenuation is increased.

Note: The deviation limiter may work which causes some TX attenuation.

2. When microphone signal drops below tuned threshold TX attenuation is increased and RX attenuation is decreased.

Note: The actual RX attenuation minimum depends on user preset speaker volume level.

3. When there are simultaneous speaker and microphone signals HF is set in duplex state where TX and RX attenuators are in middle positions.

Note: The actual RX attenuation depends on user preset speaker volume level.

10.1 Processor Functions

All audio and processor functions of the radio are located on the same PCB; other modules are interconnected through it. Only the RF-signals have a different route.

The processor controls the audio and radio units and the handset.

10.1.1 The Processor Includes

CPU	68HC11	8-bit, 8 A/D, 512*8 EEPROM, I/O
PROM	27C512	64K*8 EPROM, program memory
RAM	44658K*8 CMOS RAM	program space and short-code memory
MODEM	FX439	1200bd FFSK modem, radio path signalling
I/O		33 pcs outputs and 18 pcs inputs
DTMFTX	PCD3312	DTMF generator and tone signals
DTMFRX	MV8870	DTMF receiver
TXLOG		TX power adjustment and control

10.1.2 Connectors:

10.1.2.1 Handset:

XBUS

1	GND	ground	
2	MICF	audio signal from microphone	1 VRMS
3	AGND	audio ground	
4	AUTO-CALLF	activates the autocall function	12 V
5	EXTALF		
6			
7	I2cINTF	i2c interrupt from handset, 0-active	
8	SDAXF	i2c dataline, duplex	
9	+9VF	+9 V voltage to handset	.5 A
10	ERPF	audio earphone (VOL 0dB)	.4 VRMS
11	RXFIXF		
12	PTTF	push to talk, exterior switch to ground	
13			
14			
15	SCLXF	i2c clock to handset	0/5 V

10.1.2.2 Regulator:

X-PWR

1	VB	12 V operating voltage via relay	5 A max
2	+9V	9 V operating voltage	1 A max
3	VBAT	continuous power supply for maintaining RAM standby	
4	RELAY	current relay control, PWR on	5 V
5	SPK	audio signal to speaker amplifier	120 mV
6	IGN	activates IGN function	12 V
7	EXTAL	external alarm control, 5 V activates	
8	EXTMUTE	car radio muting 5 V activates	

10.1.2.3 Synthesizer:

X-SYNTE

1	VB	synthesizer 12 V operating voltage	
2	TXAUDIO	tx audio modulation	550 mV
3	GND	ground	
4	SRE	enable pulse for rx scaler	5 V
5	STE	enable pulse for tx scaler	5 V
6	SCLK	clock for rx and tx data	0/5 V
7	SDATA	rx and tx data for scalers	0/5 V
8	TXVCO	tx for vco ON	5 V

10.1.2.4 Receiver:

X-RX

1	+9V	operating voltage to receiver	9 V
2	RSSI	rx signal strength indicator, analog	0...5 V
3	RXAUDIO	rx audio signal	100...150 mV
4	GND	ground	

10.1.2.5 Transmitter:

X-TX

1	TXSENSE	tx power sensing, analog	0...10 V
2	TXP-WRCTR	tx power control, analog	0...9 V
3	TXBIAS	tx bias 9 V 50 mA, Ov= tx off	
4			

10.1.2.6 Accessory:

X-E1

1	TXAIN		
2	TXAOUT		
3	GND		
4	RXAIN		
5	RXAOUT		
6	VB	operating voltage	12 V
7	I2cINT	i2c interrupt, 0 active	
8	EXTi2cEN	enable to accessory's i2c bus	5 V
9	SDA	i2c data	0/5 V
10	SCL	i2c clock	0/5 V

- Power switch connected to mic line, grounds the mic line.
- Hook switch connected to erp line, dropping the dc level of the handset erp line while the handset is on the holder.

10.1.3 Circuit Diagram

The circuit diagram of the processor is divided into six parts. The first figure shows the connector interfaces and the division between audio and processor. The orther five figures illustrate the subfunctions. Audio is shown in three drawings. In the diagrams, the signals have been given names so that identical names are connected between drawings.

The circuit includes:

OACONN	figure of PCB connectors (sheet 1 of 9)
CPU	cpu, memory coding and modem (sheet 5 of 9)
MEM	memory (RAM, EPROM), supply input and start-up(sheet 7 of 9)
IO	input and output gates, DTMF rx and tx (sheet 6 of 9)
TXLOG	TX control logic (sheet 8 of 9)
AUDIO	audio power supply and block diagrams (sheet 2 of 9)
RXAUDIO	receiver audio parts (sheet 3 of 9)
TXAUDIO	transmitter audio parts (sheet 4 of 9)
SIS	sis function (sheet 9 of 9)

10.1.3.1 Component Numbering

The components on each module are numbered unambiguously. Each component number is only shown in one place. The processor has the numbers between 001 and 199, and the audio between 200 and 399.

10.1.3.2 Functions

The I050 is the processor circuit. It includes the CPU, the 512*8bit EEPROM, timers A/D converters and serial and parallel I/O lines. The X052 is an 8 MHz clock oscillator; diving this by a factor of 4 gives timing signal E.

While the processor is working, RESET is 5 V, VCC is 5 V, E is 2MHz; AS, R/W, and AO...A15 pulses must change between 0 and 5 V.

The address codes for memory circuits and external I/O-circuits are made with I103...I107. The chipselects CSR, CSP and CSIO are 0-active.

The FFSK modem I065 has its own clock X065 4.032 MHz. The modem is connected to CPU by serial lines, reception is connected to the syncron gate, and transmission is controlled by IRQ-interrupt. The modem gives 1200 Hz clock pulses RXCLK and TXCLK to the processor.

The data detector is located in the modem, and its speed is determined by C070 and C073.

The 4 MHz clock required by the audio circuit is obtained by dividing the CPU clock-signal with I062.

C040 and R040 sense the length of voltage break, the voltage drops during the break, after which the voltage is measured with an A/D converter. The time constant is approx. 10 seconds.

The program memory is in 64k*8 EPROM and it uses the addresses 4000H...FFFFH.

The RAM memory is in 8k*8 CMOS RAM using addresses 0000H...1FFFH. The power supply to RAM has three different paths: in normal use through D133, when the radio is OFF, the D135 regulates the voltage, and when the battery power is disconnected, the RAM gets its supply from A135 (3 V lithium battery).

Voltage control circuit Q128, Q130, and D126 stops the processor, and resets the control functions when the supply voltage drops below 7 V. When the voltage exceeds 8 V, the processor is restarted. The power supply switch logic I118 is also connected to RAM supply in order to maintain proper RAM functions when the radio is off.

The power switch (PWRSW) is ground-connected, and activates the current relay while pressed. The program starts and checks the PWRSWS line to ensure that the button is pressed and sets the current relay to hold mode on the PWRCTRL line. If the power switch is pressed a long time, the program trips to the PWROFF line. The C1231 and R123 maintains stored control during a short voltage break, i.e the relay becomes active again when the voltage comes back within 10 seconds. It also works as a control circuit in case of prolonged voltage-drop or processor malfunction and after 10 seconds the radio will switch off.

While the IGN line is connected, the radio is switched on when IGN rises to 12 V. The radio is switched off by the mains switch or by the handset-programmable timer (0...99 h) when IGN goes to 0.

The buffers of the i2c path (to the handset) are Q138, Q139 and I094C,D.

The external (outside CPU) I/O gates I090...I094are 8-bit addressable latches. DATA is sent ot the output determined by three address lines. When the RESET line goes down, it closes all outputs down too.

The input circuit I096 works correspondingly, except that there are inputs instead of outputs.

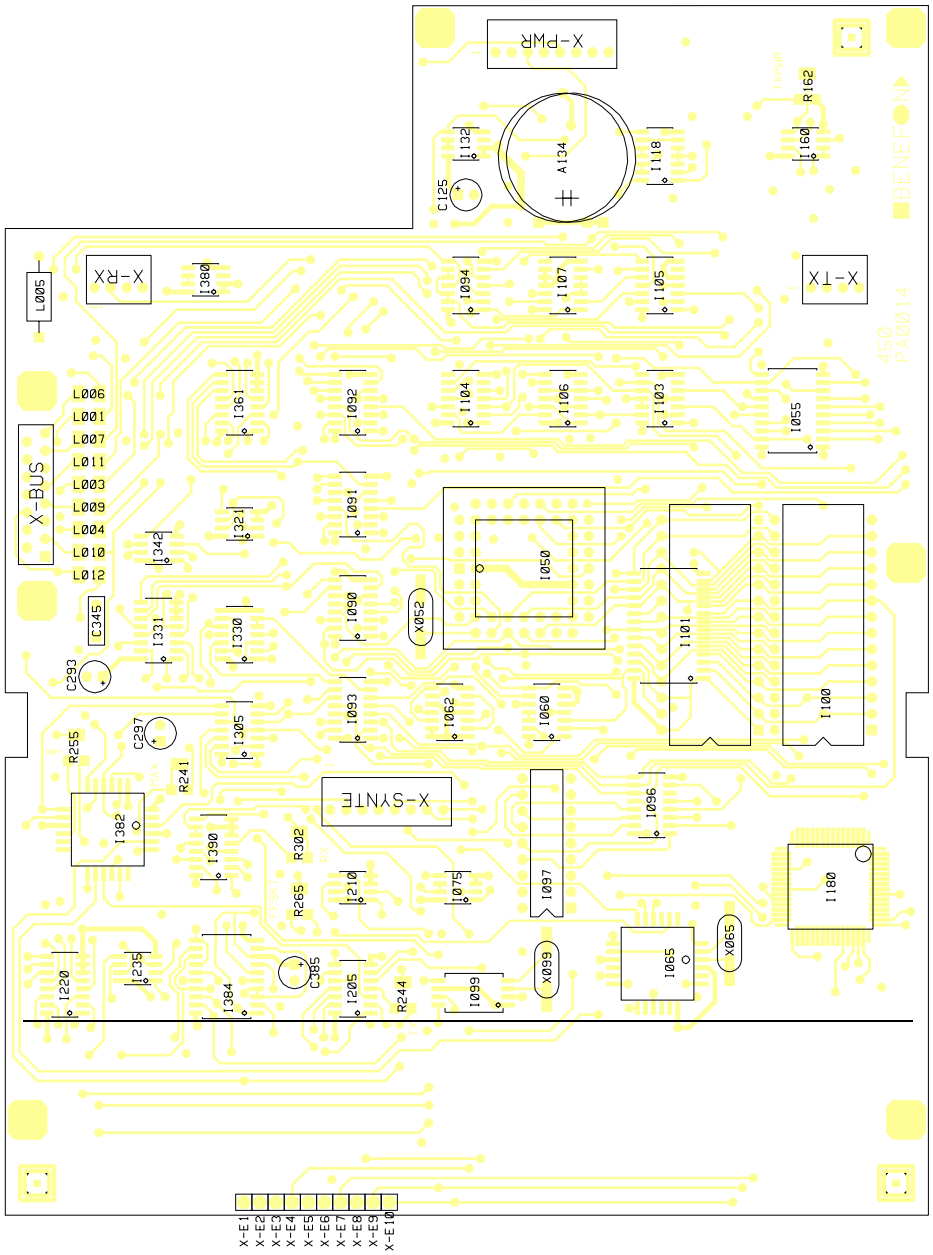
The DTMF receiver I097 gives an StD pulse at the beginning of the tone and the data is then in lines Q0...Q3. The StD closes down when the tone signal finishes.

The DTMF generator I099 is I2c bus controlled. It forms DTMF tones and all radio tone signals. The crystal X099works as a common clock for both DTMF circuits and it is controlled by the program.

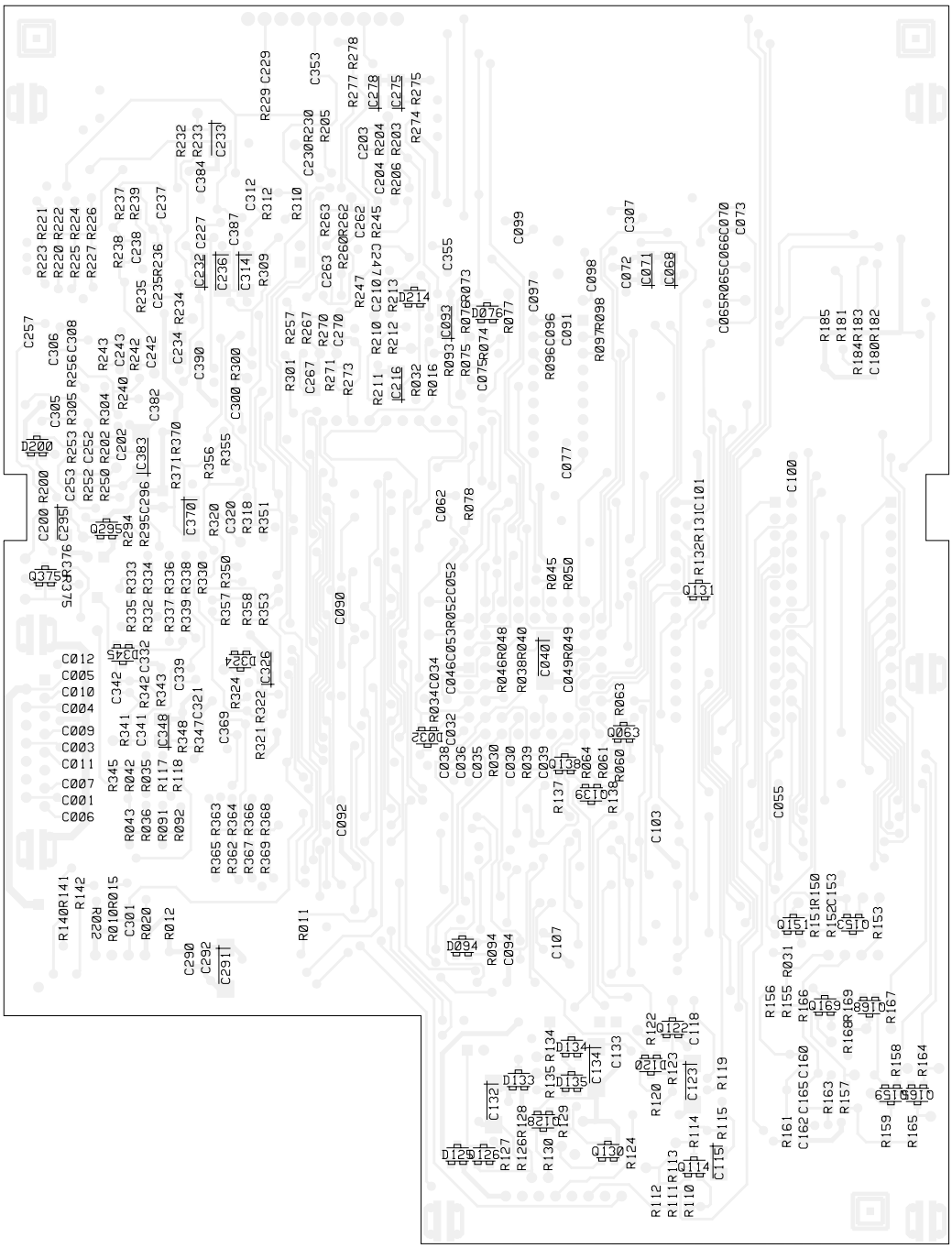
The transmitter control logic sets the TX power to the right level and turns the power off. The TXVCO signal sets the transmitter to standby mode (bias on), the TX0 and TX1 set the power levels and the TXON turns the power on and off.

TXVCO	TX0	TX1	TXON	
0	x	x	x	tx off
1	x	x	0	tx standby, no power
1	0	0	1	low tx power
1	0	1	1	medium tx power
1	1	0	1	high tx power

Component Side Layout PA0014A0 (Schematic OA0014A-I2)



Solder Side Layout PA0014A0 (Schematic OA0014A-I2)



10.1.4 Parts list

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
AB0003	A134	Lithium battery	3V 180mAh d=20mm	Matsushita	BR2032-1HG
CD0471	C001	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0471	C003	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0471	C004	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0471	C005	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0471	C006	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0471	C007	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0471	C009	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0471	C010	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0471	C011	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0471	C012	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CD0102	C030	SMD capasitor	1 nF 5 % NP0	Philips	
CD0223	C032	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C034	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C035	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C036	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C038	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C039	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CU0106	C040	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R
CD0223	C046	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C049	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0220	C052	SMD capasitor	22 pF 5% 50 V NP0	Philips	
CD0220	C053	SMD capasitor	22 pF 5% 50 V NP0	Philips	
CD0223	C055	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C062	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0330	C065	SMD capasitor	33 pF 5% 50 V NP0	Philips	
CD0330	C066	SMD capasitor	33 pF 5% 50 V NP0	Philips	
CU0105	C068	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0473	C070	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CU0105	C071	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CD0223	C072	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0473	C073	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0223	C075	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C077	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C090	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0473	C091	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0223	C092	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CU0105	C093	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CD0100	C094	SMD capasitor	10 pF/0.25pF 50 V NP0	Philips	
CC0473	C096	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0223	C097	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C098	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C099	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C100	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C101	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C103	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C107	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CU0105	C115	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CD0223	C118	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CU0106	C123	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R
CE0107	C125	Al elko	100uF 16V 7x7mm	Philips	2222 097 55101
CU0106	C132	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R
CD0223	C133	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CU0106	C134	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R
CD0223	C153	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C160	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0331	C162	SMD capasitor	330 pF 5% 50 V NP0	Philips	

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
CC0222	C165	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CD0223	C180	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0473	C200	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0102	C202	SMD capasitor	1 nF 5 % NP0	Philips	
CD0330	C203	SMD capasitor	33 pF 5% 50 V NP0	Philips	
CD0103	C204	SMD capasitor	10 nF 10% 50 V X7R	Philips	
CD0103	C210	SMD capasitor	10 nF 10% 50 V X7R	Philips	
CU0105	C216	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CD0330	C227	SMD capasitor	33 pF 5% 50 V NP0	Philips	
CD0102	C229	SMD capasitor	1 nF 5 % NP0	Philips	
CD0103	C230	SMD capasitor	10 nF 10% 50 V X7R	Philips	
CU0105	C232	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CU0105	C233	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0222	C234	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CD0330	C235	SMD capasitor	33 pF 5% 50 V NP0	Philips	
CU0225	C236	SMD tantal	2.2uF/16V 20% 4.7x2.6mm	Matsushita	ECST1CB 225R
CC0473	C237	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0100	C238	SMD capasitor	10 pF/0.25pF 50 V NP0	Philips	
CD0223	C242	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0101	C243	SMD capasitor	100 pF 5% 50 V NP0	Philips	
CC0473	C247	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0102	C252	SMD capasitor	1 nF 5% 50V NP0	Philips	
CC0102	C253	SMD capasitor	1 nF 5% 50V NP0	Philips	
CD0471	C257	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0102	C262	SMD capasitor	1 nF 5% 50V NP0	Philips	
CC0102	C263	SMD capasitor	1 nF 5% 50V NP0	Philips	
CC0222	C267	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CD0221	C270	SMD capasitor	220 pF 5% 50 V NP0	Philips	
CU0105	C275	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CU0105	C278	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CD0223	C290	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CU0106	C291	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R
CD0223	C292	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CE0107	C293	Al elko	100uF 16V 7x7mm	Philips	2222 097 55101
CU0105	C295	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CD0223	C296	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CE0107	C297	Al elko	100uF 16V 7x7mm	Philips	2222 097 55101
CD0472	C300	SMD capasitor	4.7 nF 10% 50 V X7R	Philips	
CC0473	C301	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0330	C305	SMD capasitor	33 pF 5% 50 V NP0	Philips	
CC0473	C306	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0223	C307	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0473	C308	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0221	C312	SMD capasitor	220 pF 5% 50 V NP0	Philips	
CU0225	C314	SMD tantal	2.2uF/16V 20% 4.7x2.6mm	Matsushita	ECST1CB 225R
CD0103	C320	SMD capasitor	10 nF 10% 50 V X7R	Philips	
CD0223	C321	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CU0105	C326	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CD0223	C332	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0101	C339	SMD capasitor	100 pF 5% 50 V NP0	Philips	
CC0473	C341	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0101	C342	SMD capasitor	100 pF 5% 50 V NP0	Philips	
CP0474	C345	Polyester cap	470nF 63V 10%	Evox	
CU0105	C348	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CD0223	C353	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0472	C355	SMD capasitor	4.7 nF 10% 50 V X7R	Philips	
CD0101	C369	SMD capasitor	100 pF 5% 50 V NP0	Philips	
CU0225	C370	SMD tantal	2.2uF/16V 20% 4.7x2.6mm	Matsushita	ECST1CB 225R
CD0223	C382	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CU0106	C383	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
CD0223	C384	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CE0107	C385	Al elko	100uF 16V 7x7mm	Philips	2222 097 55101
CD0223	C387	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C390	SMD capasitor	22 nF 10% 50 V X7R	Philips	
DS0070	D032	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DS0070	D076	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DS0070	D094	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DS0070	D120	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DS0070	D125	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DZ0759	D126	SMD zener	7V5 5% 300mW	Philips	BZX84C7V5
DS0070	D133	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DS0070	D134	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DZ0569	D135	SMD zener	5V6 5% 300mW	Philips	BZX84C5V6
DS0099	D200	SMD diode	70 V 200 mA	Philips	BAV 99
DS0099	D214	SMD diode	70 V 200 mA	Philips	BAV 99
DS0099	D324	SMD diode	70 V 200 mA	Philips	BAV 99
DS0099	D345	SMD diode	70 V 200 mA	Philips	BAV 99
IP6811	I050	8-BIT MIKROPROS	512 EEPROM, 8A/D, no ROM	Motorola	MC68HC11A1FN
IH0373	I055	3-st.octal latch	HCMOS	RCA	74HC373
IH0004	I060\	Hex inverter	HCMOS	RCA	74HC04
IH0074	I062\	2xD-flip-flop	HCMOS	RCA	74HC74
IX0439	I065	FFSK modem	1200 baud CMOS	CML	FX439LG
IA0272	I075\	2 x op.amp.	LinCMOS Low noise,power	Texas	TLC27M2ID
IH0259	I090	8-bit addr latch	HCMOS	RCA	74HC259
IH0259	I091	8-bit addr latch	HCMOS	RCA	74HC259
IH0259	I092	8-bit addr latch	HCMOS	RCA	74HC259
IH0259	I093	8-bit addr latch	HCMOS	RCA	74HC259
IH0032	I094\	4x2-inp OR	HCMOS	RCA	74HC32
IH0251	I096	8-inp multipl. 3-state	HCMOS	RCA	74HC251
IA8870	I097	DTMF decoder		Plessey	MV8870
II3312	I099	DTMF generator	I2C	Philips	PCD3312T
IM7512	I100	One time prom CMOS	65.536 x 8b 200ns	Fujitsu	MBM27C512P-20P
IM3664	I101	8K*8 CMOS RAM	F28GA-P 11.8mm width	Toshiba	TC5565AFL-15L
IH4002	I103\	2x4-inp NOR	HCMOS		74HC4002
IH4078	I104	1x8-inp OR/NOR	HCMOS		74HC4078
IH0004	I105\	Hex inverter	HCMOS	RCA	74HC04
IH0000	I106\	4x2-inp NAND	HCMOS		74HC00
IH0010	I107\	3x3-inp. NAND	HCMOS	RCA	74HC10
IH0132	I118\	4x2 inp NAND schm.	HCMOS	RCA	74HC132
IR2952	I132	Regulator	100mA 5V adj. 0.5%	Micrel	MIC2951-02BM
IA0272	I160\	2 x op.amp.	LinCMOS Low noise,power	Texas	TLC27M2ID
IP6831	I180	Processor (SIS)	8k maskPROM,512EEPROM	Motorola	MC68HC11A8 FU
IH4066	I205\	4xbilateral switch	HCMOS	RCA	74HC4066B
IA0272	I210\	2 x op.amp.	LinCMOS Low noise,power	Texas	TLC27M2ID
IH4051	I220	8-ch anal.multipl.	HCMOS	RCA	74HC4051B
IA0272	I235\	2 x op.amp.	LinCMOS Low noise,power	Texas	TLC27M2ID
IH4066	I305\	4xbilateral switch	HCMOS	RCA	74HC4066B
IA0272	I321\	2 x op.amp.	LinCMOS Low noise,power	Texas	TLC27M2ID
IH4066	I330\	4xbilateral switch	HCMOS	RCA	74HC4066B
IH4051	I331	8-ch anal.multipl.	HCMOS	RCA	74HC4051B
IA3182	I342\	2xop.amp.	Low power,jfet input	Motorola	MC 33182D
IH4051	I361	8-ch anal.multipl.	HCMOS	RCA	74HC4051B
IR2952	I380	Regulator	100mA 5V adj. 0.5%	Micrel	MIC2951-02BM
IX0346	I382\	Audio filter array Rx/Tx	CMOS	CML	FX346GL
IX0575	I384\	Compander		Philips	SA575
IH4053	I390\	3x2-ch analog mpxer	HCMOS	RCA	74HC4053
LC0105	L001	SMD inductor	1.0 uH	Siemens	B82412-A1102-M
LC0105	L003	SMD inductor	1.0 uH	Siemens	B82412-A1102-M
LC0105	L004	SMD inductor	1.0 uH	Siemens	B82412-A1102-M
LF0396	L005	Inductor	39 uH	Philips	

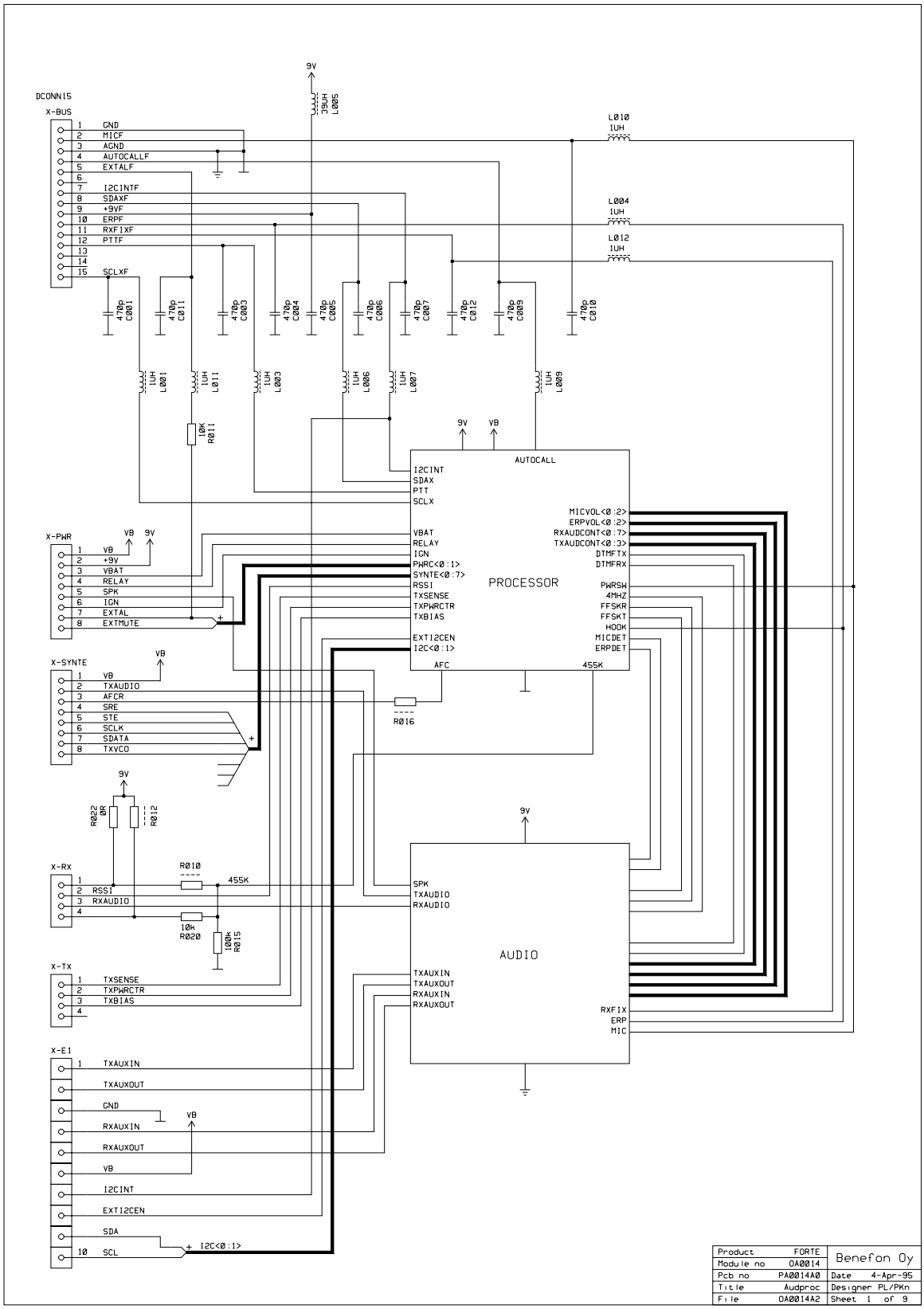
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
LC0105	L006	SMD inductor	1.0 uH	Siemens	B82412-A1102-M
LC0105	L007	SMD inductor	1.0 uH	Siemens	B82412-A1102-M
LC0105	L009	SMD inductor	1.0 uH	Siemens	B82412-A1102-M
LC0105	L010	SMD inductor	1.0 uH	Siemens	B82412-A1102-M
LC0105	L011	SMD inductor	1.0 uH	Siemens	B82412-A1102-M
LC0105	L012	SMD inductor	1.0 uH	Siemens	B82412-A1102-M
PA0014	PCB	PCB for OA0014	Forte 450 I	Aspocomp	
QSB848	Q063	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q114	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q122	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q128	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q130	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q131	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q138	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB858	Q139	SMD transistor	PNP 0.1A/30V F<10dB	Philips	BC 858 B
QSB848	Q151	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB858	Q153	SMD transistor	PNP 0.1A/30V F<10dB	Philips	BC 858 B
QSB848	Q159	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q165	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q168	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB848	Q169	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
QSB858	Q295	SMD transistor	PNP 0.1A/30V F<10dB	Philips	BC 858 B
QSB848	Q375	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
RD0103	R011	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0104	R015	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0103	R020	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0000	R022	SMD resistor	0 R	Kamaya	
RD0104	R030	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R031	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R032	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R034	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R035	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R036	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0105	R038	SMD resistor	1 M 5% 0.125 W	Kamaya	
RD0104	R039	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0105	R040	SMD resistor	1 M 5% 0.125 W	Kamaya	
RD0104	R042	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0103	R043	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0103	R045	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0104	R046	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0103	R048	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0104	R049	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0103	R050	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0105	R052	SMD resistor	1 M 5% 0.125 W	Kamaya	
RD0104	R060	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R061	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0103	R063	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0103	R064	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0105	R065	SMD resistor	1 M 5% 0.125 W	Kamaya	
RD0334	R073	SMD resistor	330 k 5% 0.125 W	Kamaya	
RD0222	R074	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RD0333	R075	SMD resistor	33 k 5% 0.125 W	Kamaya	
RD0684	R076	SMD resistor	680 k 5% 0.125 W	Kamaya	
RD0104	R077	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0101	R078	SMD resistor	100 R 5% 0.125 W	Kamaya	
RD0104	R091	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R092	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0474	R093	SMD resistor	470 k 5% 0.125 W	Kamaya	
RD0103	R094	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0474	R096	SMD resistor	470 k 5% 0.125 W	Kamaya	

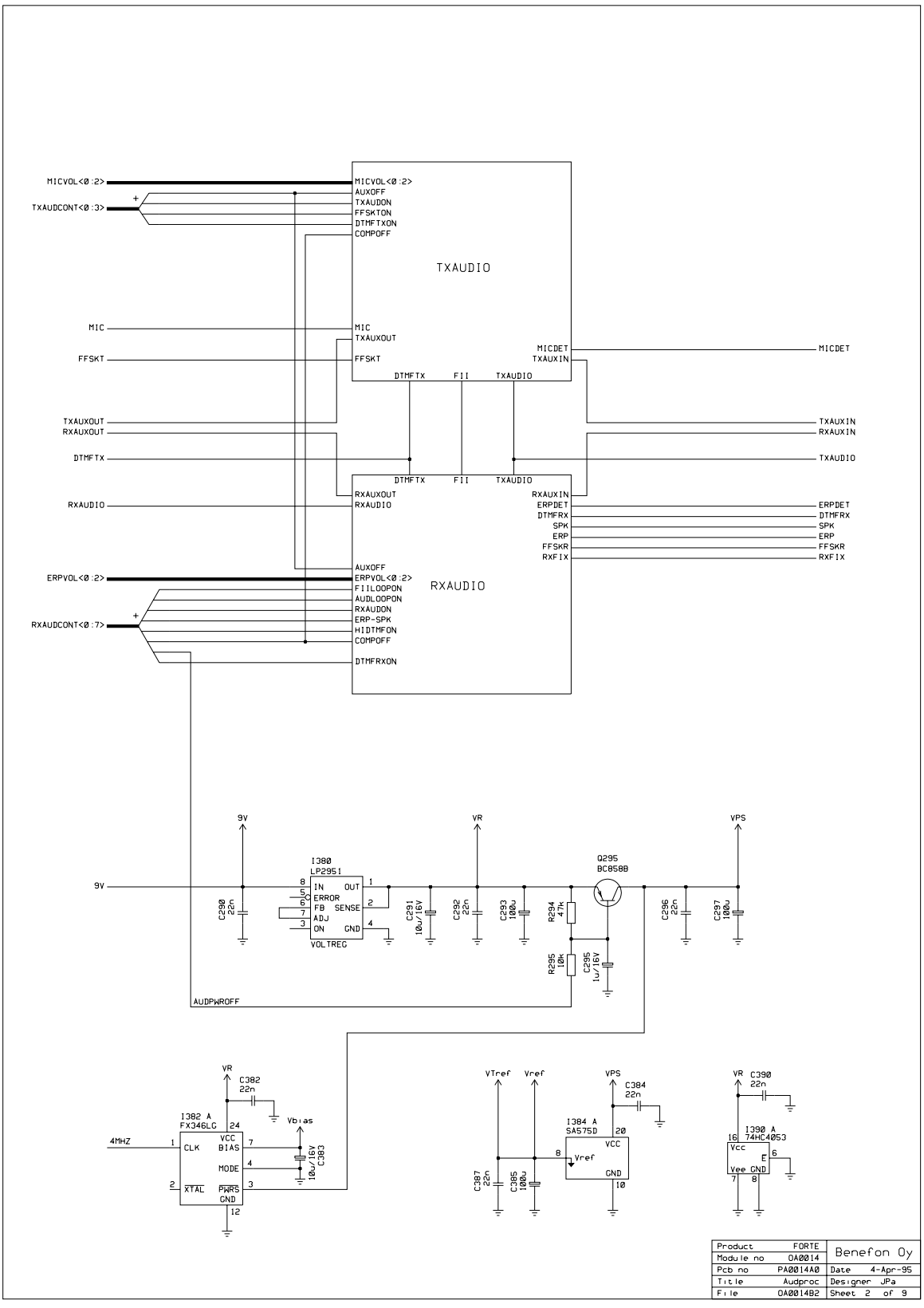
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
RD0104	R097	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R098	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R110	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R111	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R112	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0103	R113	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0104	R114	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0105	R115	SMD resistor	1 M 5% 0.125 W	Kamaya	
RD0104	R117	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R118	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R119	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0105	R120	SMD resistor	1 M 5% 0.125 W	Kamaya	
RD0104	R122	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0223	R123	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0223	R124	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0223	R126	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0223	R127	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0223	R128	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0474	R129	SMD resistor	470 k 5% 0.125 W	Kamaya	
RD0223	R130	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0223	R131	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0223	R132	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0101	R134	SMD resistor	100 R 5% 0.125 W	Kamaya	
RD0103	R135	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0104	R137	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0103	R138	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0103	R140	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0101	R141	SMD resistor	100 R 5% 0.125 W	Kamaya	
RD0101	R142	SMD resistor	100 R 5% 0.125 W	Kamaya	
RD0104	R150	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0223	R151	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0103	R152	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0101	R153	SMD resistor	100 R 5% 0.125 W	Kamaya	
RM1003	R155	Mini-Melf resistor	100k 1% 0.25W	Beyschlag	MMA 0204-50
RM1003	R156	Mini-Melf resistor	100k 1% 0.25W	Beyschlag	MMA 0204-50
RM4643	R157	Mini-Melf resistor	464k 1% 0.25W	Beyschlag	MMA 0204-50
RD0223	R158	SMD resistor	22 k 5% 0.125 W	Kamaya	
RM3922	R159	Mini-Melf resistor	39k2 1% 0.25W	Beyschlag	MMA 0204-50
RD0224	R161	SMD resistor	220 k 5% 0.125 W	Kamaya	
RI0103	R162	SMD trimmer resistor	10k 20% 0.25 W	Copal	ST-4A
RM4752	R163	Mini-Melf resistor	47k5 1% 0.25W	Beyschlag	MMA 0204-50
RD0223	R164	SMD resistor	22 k 5% 0.125 W	Kamaya	
RM1783	R165	Mini-Melf resistor	178k 1% 0.25W	Beyschlag	MMA 0204-50
RD0103	R166	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0223	R167	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0223	R168	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0223	R169	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0104	R181	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0103	R182	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0103	R183	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0103	R184	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0103	R185	SMD resistor	10 k 5% 0.125 W	Kamaya	
RM3922	R200	Mini-Melf resistor	39k2 1% 0.25W	Beyschlag	MMA 0204-50
RM1002	R202	Mini-Melf resistor	10k0 1% 0.25W	Beyschlag	MMA 0204-50
RM2003	R203	Mini-Melf resistor	200k 1% 0.25W	Beyschlag	MMA 0204-50 BL
RM3013	R205	Mini-Melf resistor	301k 1% 0.25W	Beyschlag	MMA 0204-50
RM1623	R206	Mini-Melf resistor	162k 1% 0.25W	Beyschlag	MMA 0204-50
RM3012	R210	Mini-Melf resistor	30k1 1% 0.25W	Beyschlag	MMA 0204-50
RM2213	R211	Mini-Melf resistor	221k 1% 0.25W	Beychlag	MMA 0204-50
RM6813	R212	Mini-Melf resistor	681k 1% 0.25W	Beyschlag	MMA 0204-50

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
RD0222	R213	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RM3012	R220	Mini-Melf resistor	30k1 1% 0.25W	Beyschlag	MMA 0204-50
RM4752	R221	Mini-Melf resistor	47k5 1% 0.25W	Beyschlag	MMA 0204-50
RM7502	R222	Mini-Melf resistor	75k0 1% 0.25W	Beyschlag	MMA 0204-50
RM1003	R223	Mini-Melf resistor	100k 1% 0.25W	Beyschlag	MMA 0204-50
RM1623	R224	Mini-Melf resistor	162k 1% 0.25W	Beyschlag	MMA 0204-50
RM2213	R225	Mini-Melf resistor	221k 1% 0.25W	Beychlag	MMA 0204-50
RM2373	R226	Mini-Melf resistor	237k 1% 0.25W	Beyschlag	MMA 0204-50 BL
RM3013	R227	Mini-Melf resistor	301k 1% 0.25W	Beyschlag	MMA 0204-50
RM1004	R229	Mini-Melf resistor	1.0M 1% 0.25W	Beyschlag	MMA 0204-50
RM1004	R230	Mini-Melf resistor	1.0M 1% 0.25W	Beyschlag	MMA 0204-50
RM3012	R232	Mini-Melf resistor	30k1 1% 0.25W	Beyschlag	MMA 0204-50
RM3012	R233	Mini-Melf resistor	30k1 1% 0.25W	Beyschlag	MMA 0204-50
RM1002	R234	Mini-Melf resistor	10k0 1% 0.25W	Beyschlag	MMA 0204-50
RM1623	R235	Mini-Melf resistor	162k 1% 0.25W	Beyschlag	MMA 0204-50
RM5112	R237	Mini-Melf resistor	51k1 1% 0.25W	Beyschlag	MMA 0204-50
RM3323	R238	Mini-Melf resistor	332k 1% 0.25W	Beyschlag	MMA 0204-50
RM6491	R239	Mini-Melf resistor	6k49 1% 0.25W	Beyschlag	MMA 0204-50
RD0104	R240	SMD resistor	100 k 5% 0.125 W	Kamaya	
RI0503	R241	SMD trimmer resistor	50k 20% 0.25 W	Copal	ST-4A
RM1783	R242	Mini-Melf resistor	178k 1% 0.25W	Beyschlag	MMA 0204-50
RI0503	R244	SMD trimmer resistor	50k 20% 0.25 W	Copal	ST-4A
RM2002	R245	Mini-Melf resistor	20k0 1% 0.25W	Beyschlag	MMA 0204-50
RM4752	R247	Mini-Melf resistor	47k5 1% 0.25W	Beyschlag	MMA 0204-50
RM2002	R250	Mini-Melf resistor	20k0 1% 0.25W	Beyschlag	MMA 0204-50
RM2002	R252	Mini-Melf resistor	20k0 1% 0.25W	Beyschlag	MMA 0204-50
RM1623	R253	Mini-Melf resistor	162k 1% 0.25W	Beyschlag	MMA 0204-50
RI0503	R255	SMD trimmer resistor	50k 20% 0.25 W	Copal	ST-4A
RM3012	R256	Mini-Melf resistor	30k1 1% 0.25W	Beyschlag	MMA 0204-50
RM2743	R257	Mini-Melf resistor	274k 1% 0.25W	Beyschlag	MMA 0204-50
RD0104	R260	SMD resistor	100 k 5% 0.125 W	Kamaya	
RM1002	R262	Mini-Melf resistor	10k0 1% 0.25W	Beyschlag	MMA 0204-50
RM1002	R263	Mini-Melf resistor	10k0 1% 0.25W	Beyschlag	MMA 0204-50
RI0503	R265	SMD trimmer resistor	50k 20% 0.25 W	Copal	ST-4A
RM1002	R267	Mini-Melf resistor	10k0 1% 0.25W	Beyschlag	MMA 0204-50
RD0683	R270	SMD resistor	68 k 5% 0.125 W	Kamaya	
RD0103	R271	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0104	R274	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R275	SMD resistor	100 k 5% 0.125 W	Kamaya	
RM1003	R277	Mini-Melf resistor	100k 1% 0.25W	Beyschlag	MMA 0204-50
RM4752	R278	Mini-Melf resistor	47k5 1% 0.25W	Beyschlag	MMA 0204-50
RD0473	R294	SMD resistor	47 k 5% 0.125 W	Kamaya	
RD0103	R295	SMD resistor	10 k 5% 0.125 W	Kamaya	
RM3013	R300	Mini-Melf resistor	301k 1% 0.25W	Beyschlag	MMA 0204-50
RD0224	R301	SMD resistor	220 k 5% 0.125 W	Kamaya	
RI0503	R302	SMD trimmer resistor	50k 20% 0.25 W	Copal	ST-4A
RM4752	R304	Mini-Melf resistor	47k5 1% 0.25W	Beyschlag	MMA 0204-50
RM2743	R305	Mini-Melf resistor	274k 1% 0.25W	Beyschlag	MMA 0204-50
RM3922	R309	Mini-Melf resistor	39k2 1% 0.25W	Beyschlag	MMA 0204-50
RM1783	R310	Mini-Melf resistor	178k 1% 0.25W	Beyschlag	MMA 0204-50
RM3922	R312	Mini-Melf resistor	39k2 1% 0.25W	Beyschlag	MMA 0204-50
RD0224	R318	SMD resistor	220 k 5% 0.125 W	Kamaya	
RM1183	R320	Mini-Melf resistor	118k 1% 0.25W	Beyschlag	MMA 0204-50
RM1003	R321	Mini-Melf resistor	100k 1% 0.25W	Beyschlag	MMA 0204-50
RM1004	R322	Mini-Melf resistor	1.0M 1% 0.25W	Beyschlag	MMA 0204-50
RD0222	R324	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RM1623	R330	Mini-Melf resistor	162k 1% 0.25W	Beyschlag	MMA 0204-50
RM1502	R332	Mini-Melf resistor	15k0 1% 0.25W	Beyschlag	MMA 0204-50
RM2002	R333	Mini-Melf resistor	20k0 1% 0.25W	Beyschlag	MMA 0204-50
RM3012	R334	Mini-Melf resistor	30k1 1% 0.25W	Beyschlag	MMA 0204-50

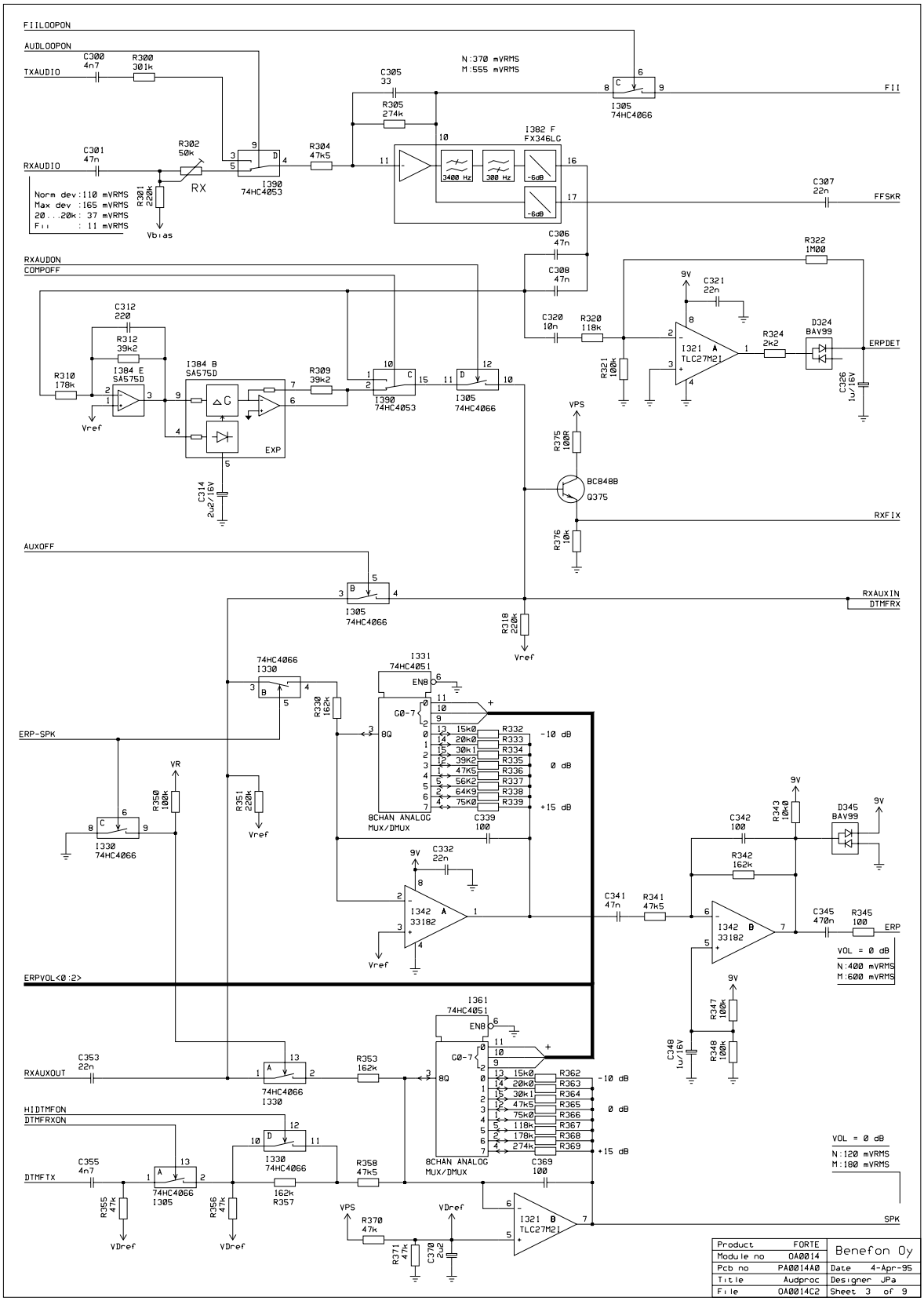
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
RM3922	R335	Mini-Melf resistor	39k2 1% 0.25W	Beyschlag	MMA 0204-50
RM4752	R336	Mini-Melf resistor	47k5 1% 0.25W	Beyschlag	MMA 0204-50
RM5622	R337	Mini-Melf resistor	56k2 1% 0.25W	Beyschlag	MMA 0204-50
RM6492	R338	Mini-Melf resistor	64k9 1% 0.25W	Beyschlag	MMA 0204-50 BL
RM7502	R339	Mini-Melf resistor	75k0 1% 0.25W	Beyschlag	MMA 0204-50
RM4752	R341	Mini-Melf resistor	47k5 1% 0.25W	Beyschlag	MMA 0204-50
RM1623	R342	Mini-Melf resistor	162k 1% 0.25W	Beyschlag	MMA 0204-50
RM1002	R343	Mini-Melf resistor	10k0 1% 0.25W	Beyschlag	MMA 0204-50
RD0101	R345	SMD resistor	100 R 5% 0.125 W	Kamaya	
RM1003	R347	Mini-Melf resistor	100k 1% 0.25W	Beyschlag	MMA 0204-50
RM1003	R348	Mini-Melf resistor	100k 1% 0.25W	Beyschlag	MMA 0204-50
RD0104	R350	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0224	R351	SMD resistor	220 k 5% 0.125 W	Kamaya	
RM1623	R353	Mini-Melf resistor	162k 1% 0.25W	Beyschlag	MMA 0204-50
RD0473	R355	SMD resistor	47 k 5% 0.125 W	Kamaya	
RD0473	R356	SMD resistor	47 k 5% 0.125 W	Kamaya	
RM1623	R357	Mini-Melf resistor	162k 1% 0.25W	Beyschlag	MMA 0204-50
RM4752	R358	Mini-Melf resistor	47k5 1% 0.25W	Beyschlag	MMA 0204-50
RM1502	R362	Mini-Melf resistor	15k0 1% 0.25W	Beyschlag	MMA 0204-50
RM2002	R363	Mini-Melf resistor	20k0 1% 0.25W	Beyschlag	MMA 0204-50
RM3012	R364	Mini-Melf resistor	30k1 1% 0.25W	Beyschlag	MMA 0204-50
RM4752	R365	Mini-Melf resistor	47k5 1% 0.25W	Beyschlag	MMA 0204-50
RM7502	R366	Mini-Melf resistor	75k0 1% 0.25W	Beyschlag	MMA 0204-50
RM1183	R367	Mini-Melf resistor	118k 1% 0.25W	Beyschlag	MMA 0204-50
RM1783	R368	Mini-Melf resistor	178k 1% 0.25W	Beyschlag	MMA 0204-50
RM2743	R369	Mini-Melf resistor	274k 1% 0.25W	Beyschlag	MMA 0204-50
RD0473	R370	SMD resistor	47 k 5% 0.125 W	Kamaya	
RD0473	R371	SMD resistor	47 k 5% 0.125 W	Kamaya	
RD0101	R375	SMD resistor	100 R 5% 0.125 W	Kamaya	
RD0103	R376	SMD resistor	10 k 5% 0.125 W	Kamaya	
VI0052	V100	IC - socket	PLCC-52 1R piikit	Methode	
VI0028	V140	IC -socket	DIL-28		
VI0028	V141	IC -socket	DIL-28		
VD0016	X-BUS	D-connector	D-15S 90 ast.kulma	Cannon	DA121073-5044
VI0102	X-E1	Lead socket	d=1.35mm,1.8mm h=4.2mm	Assmann	AP 102 B/g
VI0102	X-E10	Lead socket	d=1.35mm,1.8mm h=4.2mm	Assmann	AP 102 B/g
VI0102	X-E2	Lead socket	d=1.35mm,1.8mm h=4.2mm	Assmann	AP 102 B/g
VI0102	X-E3	Lead socket	d=1.35mm,1.8mm h=4.2mm	Assmann	AP 102 B/g
VI0102	X-E4	Lead socket	d=1.35mm,1.8mm h=4.2mm	Assmann	AP 102 B/g
VI0102	X-E5	Lead socket	d=1.35mm,1.8mm h=4.2mm	Assmann	AP 102 B/g
VI0102	X-E6	Lead socket	d=1.35mm,1.8mm h=4.2mm	Assmann	AP 102 B/g
VI0102	X-E7	Lead socket	d=1.35mm,1.8mm h=4.2mm	Assmann	AP 102 B/g
VI0102	X-E8	Lead socket	d=1.35mm,1.8mm h=4.2mm	Assmann	AP 102 B/g
VI0102	X-E9	Lead socket	d=1.35mm,1.8mm h=4.2mm	Assmann	AP 102 B/g
VN0108	X-PWR	8-pin connector		Wisher	WKP-N8B1G-L
VN0104	X-RX	4-pin connector		Wisher	WKP-N4B1G-L
VN0108	X-SYN	8-pin connector		Wisher	WKP-N8B1G-L
VN0104	X-TX	4-pin connector		Wisher	WKP-N4B1G-L
X80006	X052	Crystal	8.0000 MHz	Telequartz	8.00MHZ/B
X40326	X065	Crystal	4.032 MHz -+30ppm	Meiden	MQX-3H2-04032-20
X35796	X099	DTMF-quartz crystal	3.579545 MHZ +-30PPM	Meiden	

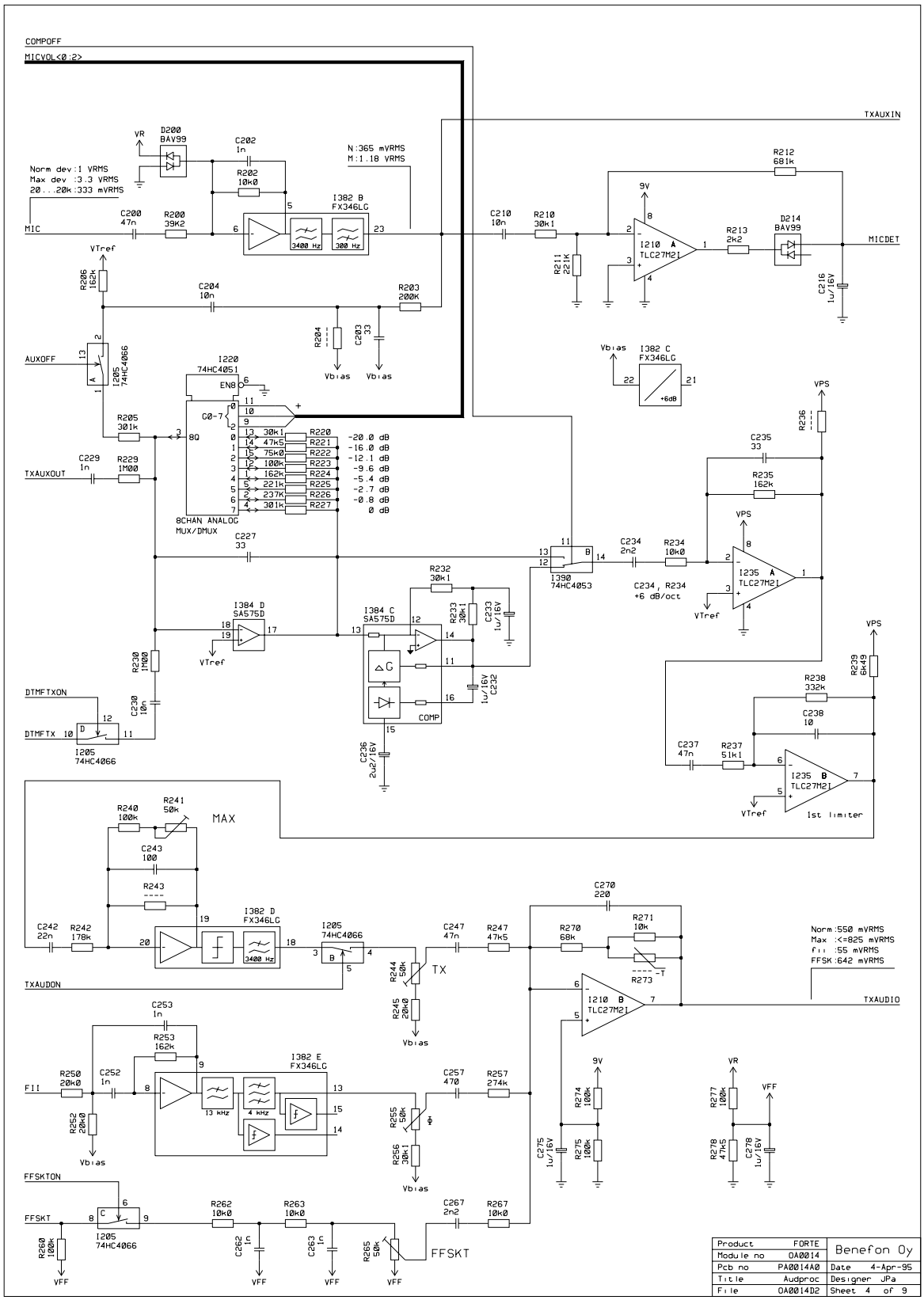
Last
update
18.04.95

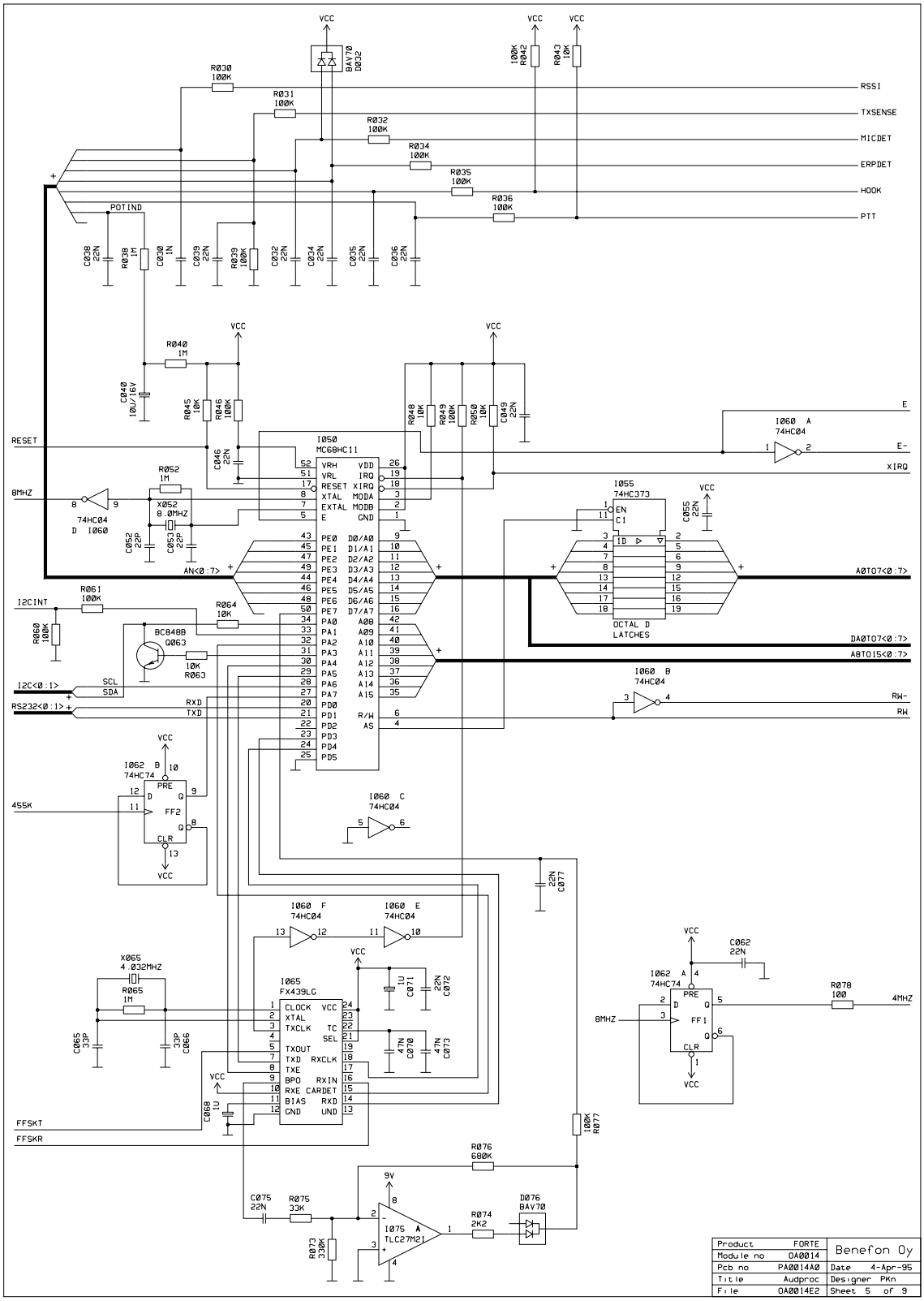

DCONN15
X-BUS
1 GND
2 MICF
3 AGND
4 AUTOCALLF
5 EXTALF
6
7 I2C1NTF
8 SDAXF
9 +9VF
10 ERPF
11 RXF1XF
12 PTTF
13
14
15 SCLXF
9V
39UH L005
L010 1UH
L004 1UH
L012 1UH
470p C001
470p C011
470p C003
470p C004
470p C005
470p C006
470p C007
470p C012
470p C009
470p C010
1UH L001
1UH L011
1UH L003
1UH L006
1UH L007
1UH L009
10K R011
VB
AUTOCALL
I2CINT
SDAX
PTT
SCLX
MICVOL<0:2>
ERPVOL<0:2>
RXAUDCONT<0:7>
TXAUDCONT<0:3>
DTMFTX
DTMFRX
VBAT
RELAY
IGN
PWRC<0:1>
SYNTE<0:7>
RSSI
TXSENSE
TXPWRCTR
TXBIAS
PROCESSOR
PWRSW
4MHZ
FFSKR
FFSKT
HOOK
MICDET
ERPDET
EXTI2CEN
I2C<0:1>
AFC
455K
X-PWR
1 VB
2 +9V
3 VBAT
4 RELAY
5 SPK
6 IGN
7 EXTAL
8 EXTMUTE
X-SYNTE
1 VB
2 TXAUDIO
3 AFCR
4 SRE
5 STE
6 SCLK
7 SDATA
8 TXVCO
R016
R022 0R
R012
R010
455K
X-RX
1
2 RSSI
3 RXAUDIO
4
10k R020
100k R015
SPK
TXAUDIO
RXAUDIO
AUDIO
TXAUXIN
TXAUXOUT
RXAUXIN
RXAUXOUT
RXF1X
ERP
MIC
X-TX
1 TXSENSE
2 TXPWRCTR
3 TXBIAS
4
X-E1
1 TXAUXIN
TXAUXOUT
GND
RXAUXIN
RXAUXOUT
VB
I2CINT
EXTI2CEN
SDA
10 SCL
I2C<0:1>
Product FORTE
Module no OA0014
Pcb no PA0014A0
Title Audproc
File OA0014A2
Benefon Oy
Date 4-Apr-95
Designer PL/PKn
Sheet 1 of 9

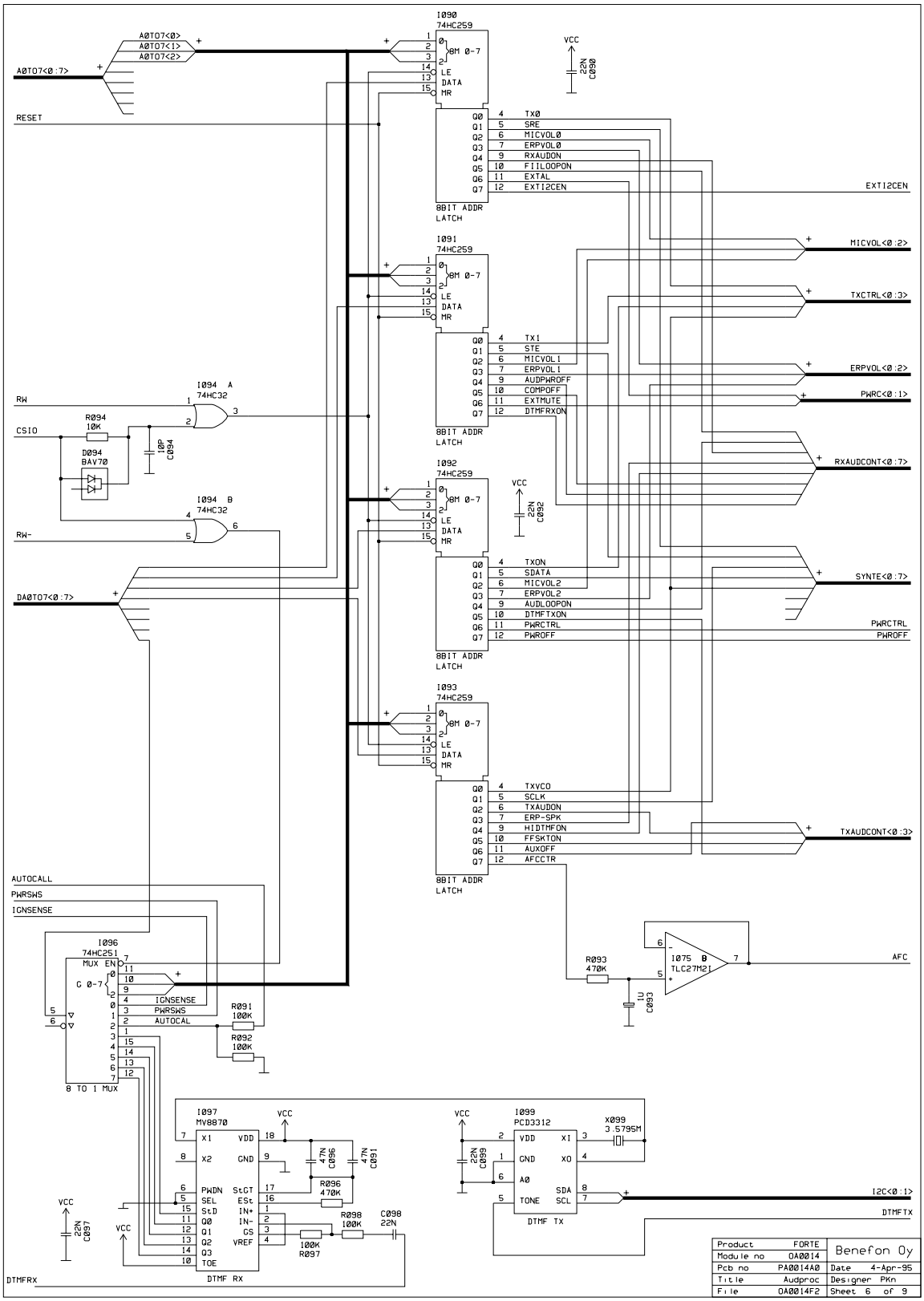


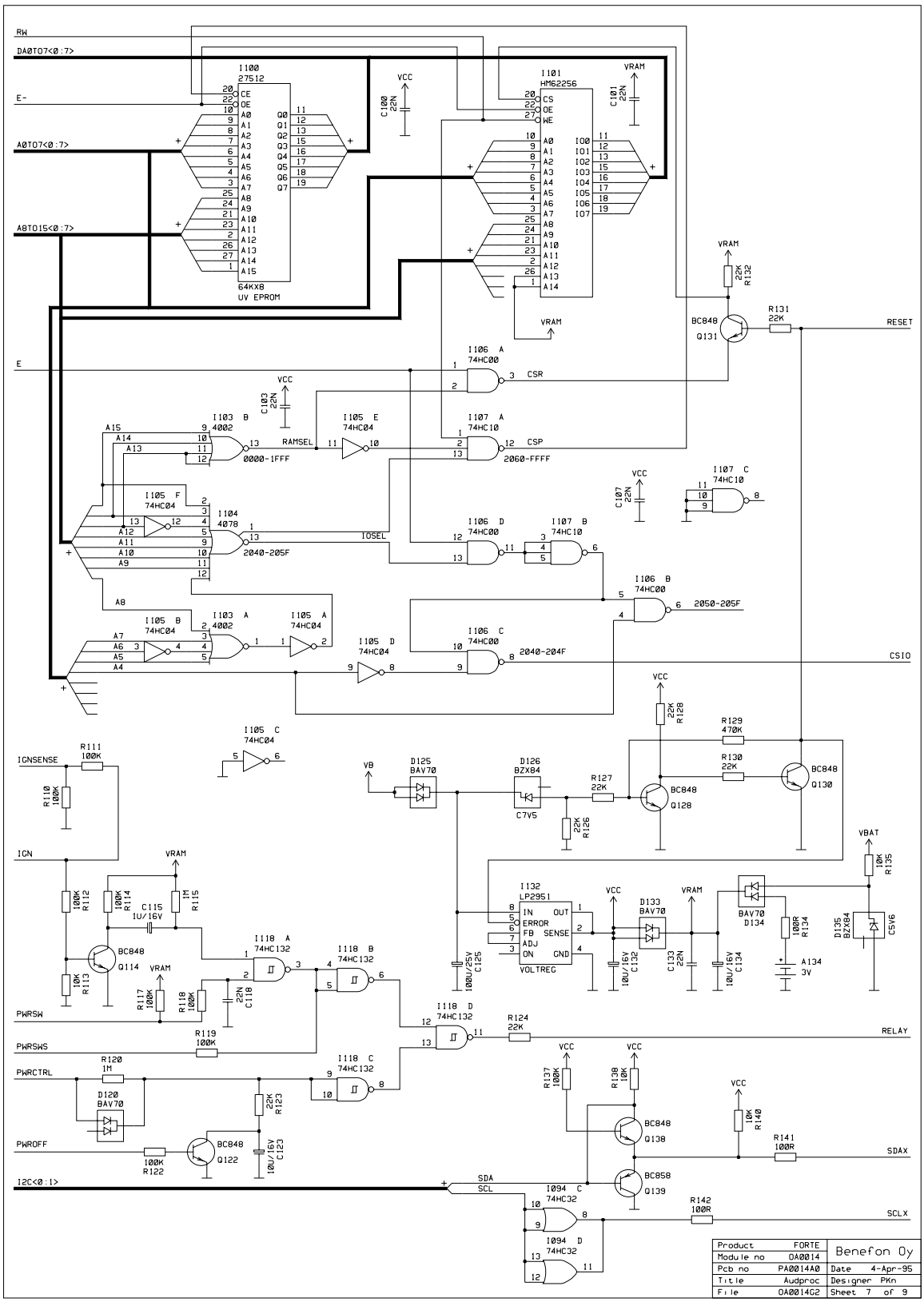
Product	FORTE	Benefon Oy	
Module no	OA0014		
Pcb no	PA0014A0	Date	4-Apr-95
Title	Audproc	Designer	JPa
File	OA0014B2	Sheet	2 of 9

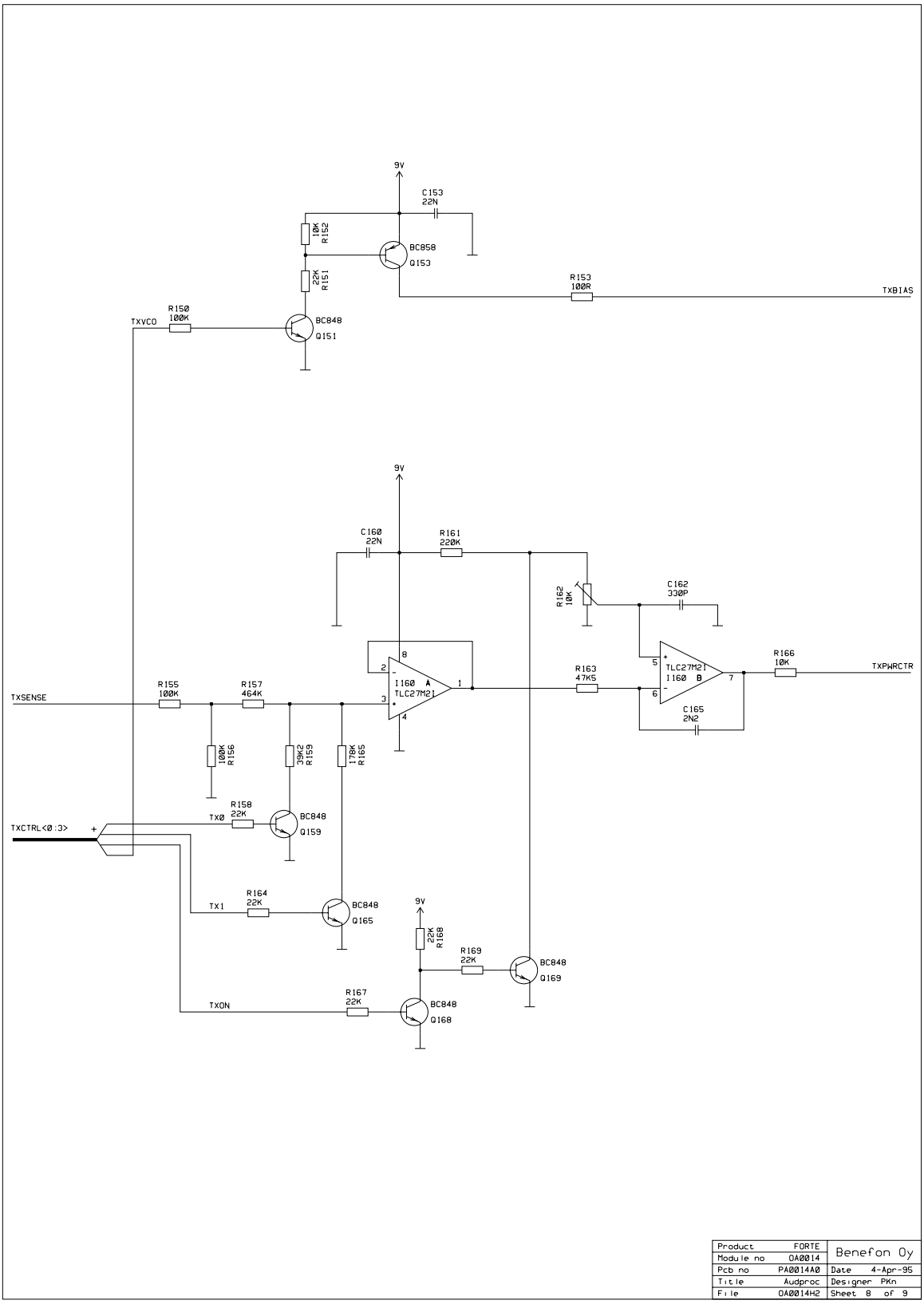

FIILOOPON
AUDLOOPON
TXAUDIO
RXAUDIO
FII
FFSKR
RXAUDON
COMPOFF
ERPDET
AUXOFF
RXFIX
RXAUXIN
DTMFRX
ERP-SPK
ERPVOL<0:2>
RXAUXOUT
HIDTMFON
DTMFRXON
DTMFTX
ERP
SPK
VOL = 0 dB
N:400 mVRMS
M:600 mVRMS
VOL = 0 dB
N:120 mVRMS
M:180 mVRMS
Norm dev :110 mVRMS
Max dev :165 mVRMS
20...20k: 37 mVRMS
Fii : 11 mVRMS
N:370 mVRMS
M:555 mVRMS
Vbias
Vref
VPS
VDref
9V
RX
EXP
8CHAN ANALOG MUX/DMUX
-10 dB
0 dB
+15 dB
74HC4066
74HC4053
74HC4051
TLC27M21
33182
BC848B
BAV99
Product FORTE
Module no 0A0014
Pcb no PA0014A0
Title Audproc
File 0A0014C2
Benefon Oy
Date 4-Apr-95
Designer JPa
Sheet 3 of 9

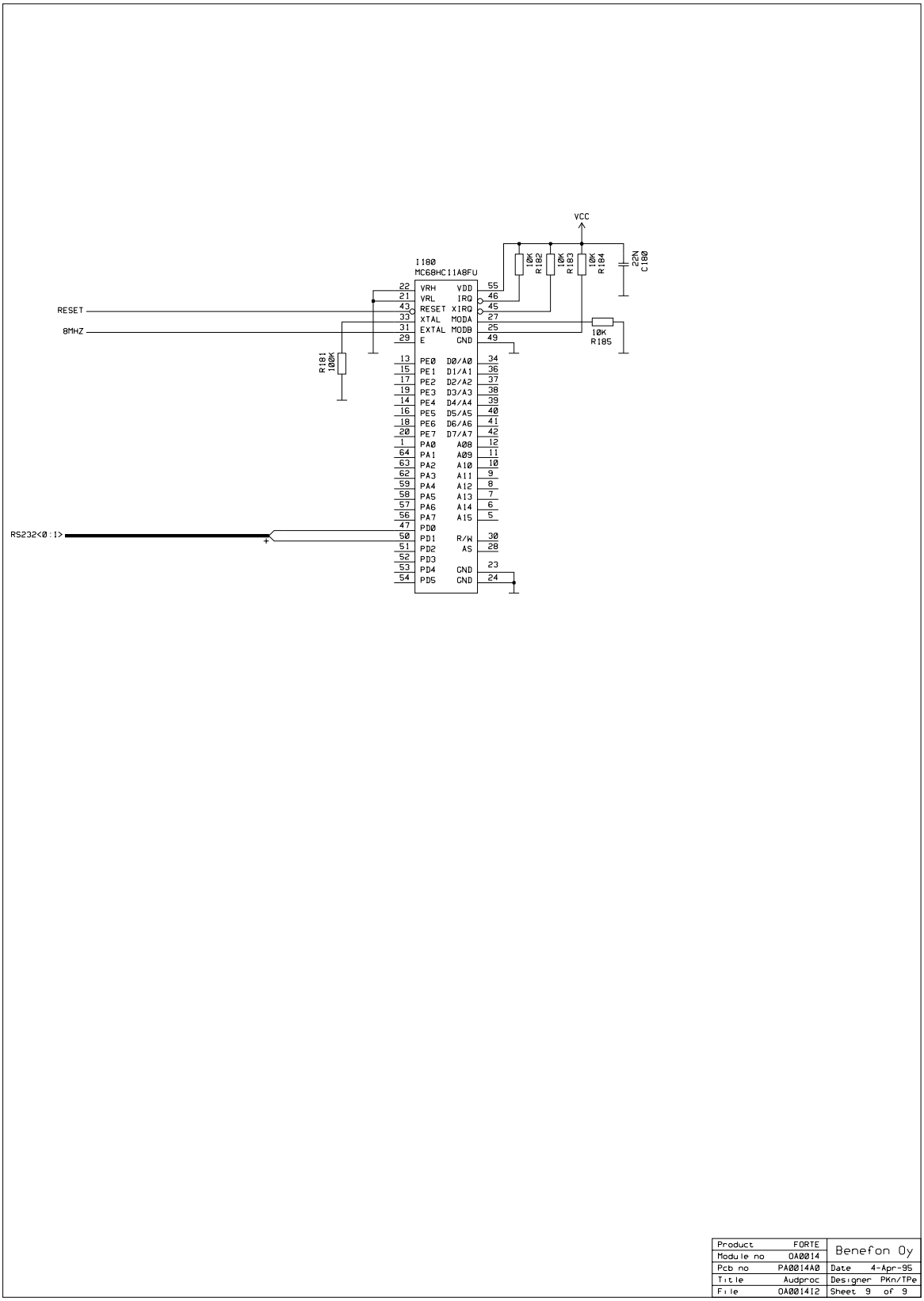

COMPOFF
MICVOL<0:2>
TXAUXIN
MIC
MICDET
AUXOFF
TXAUXOUT
8CHAN ANALOG MUX/DMUX
DTMFTXON
DTMFTX
TXAUDON
TXAUDIO
FFSKTON
FFSKT
FII
TX
FFSKT
MAX
1st limiter
COMP
VTref
VPS
VFF
Vbias
Norm dev:1 VRMS
Max dev :3.3 VRMS
20...20k:333 mVRMS
N:365 mVRMS
M:1.18 VRMS
Norm:550 mVRMS
Max :<=825 mVRMS
fii :55 mVRMS
FFSK:642 mVRMS
-20.0 dB
-16.0 dB
-12.1 dB
-9.6 dB
-5.4 dB
-2.7 dB
-0.8 dB
0 dB
+6 dB/oct
Product FORTE
Module no OA0014
Pcb no PA0014A0
Title Audproc
File OA0014D2
Benefon Oy
Date 4-Apr-95
Designer JPa
Sheet 4 of 9


VCC
BAV70 D032
R030 100K
R031 100K
R032 100K
R034 100K
R035 100K
R036 100K
100K R042
R043 10K
RSSI
TXSENSE
MICDET
ERPDET
HOOK
PTT
POTIND
C038 22N
R038 1M
C030 1N
C039 22N
R039 100K
C032 22N
C034 22N
C035 22N
C036 22N
R040 1M
C040 10U/16V
R045 10K
R044 100K
C046 22N
R049 10K
R048 100K
R050 10K
C049 22N
RESET
8MHZ
74HC04
R052 1M
X052 8.0MHZ
C052 22P
C053 22P
I050 MC68HC11
VRH VDD
VRL IRQ
RESET XIRQ
XTAL MODA
EXTAL MODB
E GND
PE0 D0/A0
PE1 D1/A1
PE2 D2/A2
PE3 D3/A3
PE4 D4/A4
PE5 D5/A5
PE6 D6/A6
PE7 D7/A7
PA0 A08
PA1 A09
PA2 A10
PA3 A11
PA4 A12
PA5 A13
PA6 A14
PA7 A15
PD0
PD1 R/W
PD2 AS
PD3
PD4
PD5
AN<0:7>
I060 A 74HC04
E
E-
XIRQ
I055 74HC373
EN
C1
OCTAL D LATCHES
C055 22N
A0TO7<0:7>
DA0TO7<0:7>
A8TO15<0:7>
R061 100K
R060 100K
R064 10K
BC848B Q063
10K R063
I2C<0:1>
SCL
SDA
RS232<0:1>
RXD
TXD
I060 B 74HC04
RW-
RW
I062 B 74HC74
PRE
FF2
CLR
455K
I060 C 74HC04
I060 F 74HC04
I060 E 74HC04
C077 22N
X065 4.032MHZ
R065 1M
C065 33P
C066 33P
I065 FX439LG
CLOCK VCC
XTAL
TXCLK TC
SEL
TXOUT
TXD RXCLK
TXE
BPO RXIN
RXE CARDET
BIAS RXD
GND UND
C071 1U
C072 22N
C070 47N
C073 47N
C068 1U
FFSKT
FFSKR
100K R077
R076 680K
9V
C075 22N
R075 33K
R073 330K
I075 A TLC27M2I
R074 2K2
D076 BAV70
C062 22N
I062 A 74HC74
R078 100
4MHZ
Product FORTE
Module no OA0014
Pcb no PA0014A0
Title Audproc
File OA0014E2
Benefon Oy
Date 4-Apr-95
Designer PKn
Sheet 5 of 9


I090
74HC259
A0TO7<0>
A0TO7<1>
A0TO7<2>
A0TO7<0:7>
RESET
8M 0-7
LE
DATA
MR
VCC
C090
22N
Q0 TX0
Q1 SRE
Q2 MICVOL0
Q3 ERPVOL0
Q4 RXAUDON
Q5 FIILOOPON
Q6 EXTAL
Q7 EXTI2CEN
8BIT ADDR
LATCH
EXTI2CEN
I091
74HC259
Q0 TX1
Q1 STE
Q2 MICVOL1
Q3 ERPVOL1
Q4 AUDPWROFF
Q5 COMPOFF
Q6 EXTMUTE
Q7 DTMFRXON
MICVOL<0:2>
TXCTRL<0:3>
ERPVOL<0:2>
PWRC<0:1>
I094 A
74HC32
RW
CSIO
R094
10K
D094
BAV70
C094
10P
I094 B
74HC32
RW-
I092
74HC259
C092
22N
Q0 TXON
Q1 SDATA
Q2 MICVOL2
Q3 ERPVOL2
Q4 AUDLOOPON
Q5 DTMFTXON
Q6 PWRCTRL
Q7 PWROFF
RXAUDCONT<0:7>
SYNTE<0:7>
PWRCTRL
PWROFF
DA0TO7<0:7>
I093
74HC259
Q0 TXVCO
Q1 SCLK
Q2 TXAUDON
Q3 ERP-SPK
Q4 HIDTMFON
Q5 FFSKTON
Q6 AUXOFF
Q7 AFCCTR
TXAUDCONT<0:3>
AUTOCALL
PWRSWS
IGNSENSE
I096
74HC251
MUX EN
G 0-7
IGNSENSE
PWRSWS
AUTOCAL
8 TO 1 MUX
R091
100K
R092
100K
R093
470K
I075 B
TLC27M2I
C093
1U
AFC
I097
MV8870
X1
X2
PWDN
SEL
StD
Q0
Q1
Q2
Q3
TOE
VDD
GND
StGT
ESt
IN+
IN-
OS
VREF
C096
47N
C091
47N
R096
470K
R098
100K
C098
22N
R097
100K
C097
22N
DTMF RX
DTMFRX
I099
PCD3312
VDD
GND
A0
TONE
XI
XO
SDA
SCL
C099
22N
X099
3.5795M
I2C<0:1>
DTMFTX
DTMF TX
Product FORTE
Module no OA0014
Pcb no PA0014A0
Title Audproc
File OA0014F2
Benefon Oy
Date 4-Apr-95
Designer PKn
Sheet 6 of 9


RW
DA0TO7<0:7>
E-
A0TO7<0:7>
A8TO15<0:7>
E
I100
27512
64KX8
UV EPROM
I101
HM62256
VRAM
VCC
C100 22N
C101 22N
C103 22N
C107 22N
R131 22K
R132 22K
BC848
Q131
RESET
I106 A
74HC00
CSR
I103 B
4002
0000-1FFF
RAMSEL
I105 E
74HC04
I107 A
74HC10
CSP
2060-FFFF
I105 F
74HC04
I104
4078
2040-205F
IOSEL
I106 D
74HC00
I107 B
74HC10
I107 C
74HC10
I106 B
74HC00
2050-205F
A8
I105 B
74HC04
I103 A
4002
I105 A
74HC04
I105 D
74HC04
I106 C
74HC00
2040-204F
CSIO
I105 C
74HC04
R111 100K
R110 100K
IGNSENSE
IGN
R112 100K
R114 100K
R115 1M
C115 1U/16V
BC848
Q114
R113 10K
R117 100K
R118 100K
C118 22N
I118 A
74HC132
I118 B
74HC132
PWRSW
PWRSWS
R119 100K
I118 D
74HC132
R124 22K
RELAY
PWRCTRL
R120 1M
D120
BAV70
I118 C
74HC132
PWROFF
R122 100K
BC848
Q122
R123 22K
C123 10U/16V
I2C<0:1>
SDA
SCL
I094 C
74HC32
I094 D
74HC32
R142 100R
SCLX
R137 100K
R138 10K
BC848
Q138
BC858
Q139
R140 10K
R141 100R
SDAX
VB
D125
BAV70
D126
BZX84
C7V5
R127 22K
R126 22K
BC848
Q128
R128 22K
R129 470K
R130 22K
BC848
Q130
VBAT
R135 10K
I132
LP2951
IN
OUT
ERROR
FB
SENSE
ADJ
ON
GND
VOLTREG
C125 100U/25V
C132 10U/16V
D133
BAV70
C133 22N
C134 10U/16V
BAV70
D134
R134 100R
A134
3V
D135
BZX84
C5V6
Product FORTE
Module no OA0014
Pcb no PA0014A0
Title Audproc
File OA0014G2
Benefon Oy
Date 4-Apr-95
Designer PKn
Sheet 7 of 9


9V
C153
22N
R152
10K
BC858
Q153
R151
22K
R153
100R
TXBIAS
R150
100K
TXVCO
BC848
Q151
9V
C160
22N
R161
220K
R162
10K
C162
330P
I160 A
TLC27M21
I160 B
TLC27M21
R166
10K
TXPWRCTR
R163
47K5
C165
2N2
TXSENSE
R155
100K
R157
464K
R156
100K
R159
39K2
R165
178K
R158
22K
TX0
BC848
Q159
TXCTRL<0:3>
R164
22K
TX1
BC848
Q165
9V
R168
22K
R169
22K
BC848
Q169
R167
22K
TXON
BC848
Q168
Product FORTE
Module no 0A0014
Pcb no PA0014A0
Title Audproc
File 0A0014H2
Benefon Oy
Date 4-Apr-95
Designer PKn
Sheet 8 of 9


VCC
I180
MC68HC11A8FU
RESET
8MHZ
RS232<0:1>
R181 100K
R182 10K
R183 10K
R184 10K
R185 10K
C180 22N
VRH VDD
VRL IRQ
RESET XIRQ
XTAL MODA
EXTAL MODB
E GND
PE0 D0/A0
PE1 D1/A1
PE2 D2/A2
PE3 D3/A3
PE4 D4/A4
PE5 D5/A5
PE6 D6/A6
PE7 D7/A7
PA0 A08
PA1 A09
PA2 A10
PA3 A11
PA4 A12
PA5 A13
PA6 A14
PA7 A15
PD0
PD1 R/W
PD2 AS
PD3
PD4 GND
PD5 GND
Product FORTE
Module no OA0014
Pcb no PA0014A0
Title Audproc
File OA001412
Benefon Oy
Date 4-Apr-95
Designer PKn/TPe
Sheet 9 of 9

11.0 PRINCIPLES OF HANDSET OPERATION

OH0002 Handset

11.0.1 Connector Signals:

pin	signal	
1	9V	9 V operating voltage
2	ERP	earphone input, HOOK (VOL = 0 dB, norm dev. 300 mVrms) (HOOK, 5 V / 0 V)
3	GND	logic ground, erphone audio-ground
4	SDA	data for I2C path
5	SCL	clock for I2C path
6	I2CINT	interrupt for I2C path
7	AGND	microphone audio-ground
8	EXT-MIC	microphone HF input
9	-	
10	mic	microphone output, PWR (normal deviation 1 Vrms) (PWR, 5 V / 0 V)

11.0.2 Audio

I202 A and B are parallel audio-switches, and operate the earphone audio functions. Operational amplifiers I206 A and B are inter-connected and provide a push-pull input for the earphone capsule. Components 270-272 constitute a HOOK connection.

Audio switches I230 A and B activate either the normal- (A223) or HF-microphone. I228B works as preamplifier for both microphones, and I228A is an active low-pass filter, having a cut-off frequency of approx 3400 Hz. I230 C and D are parallel switches for microphone audio.

11.0.3 Automatic Control For Keyboard And Lcd Backlight

Light dependable resistor (R130) controls I135A, which feeds transistor Q132. Q132 adjusts supply voltage (about 6...8V) to the backlight leds. IC circuit I135B switches off the lights totally when ambient lighting increases enough.

11.0.4 Leds

LEDs D141-D146 illuminate LCD, and D151-D164 illuminate the keyboard. The radio may turn both of them separately on and off. In bright light, the illumination is also turned off by the dimmer-control.

Symbol- LEDs D171, D173, D175, D177, D179, and D180 can all be individually switched on and off. They have no brightness control. The LED series resistors adjus LEDs of different colors to the same brightness. All LED controls come from I130, which is an I/O circuit controlled by I2C path. Pins A0, A1 and A2 are used for coding all circuits to different path addresses so that the radio can control them individually.

11.0.5 Keyboard

The keyboard is controlled primarily by I110, and partly by I120. The keyboard base is rubber matting, and the contacts are PCB foils. The I/O-lines of I120 have been determined as outputs, and the I110 I/O-lines are all inputs. In stand-by, the inputs are at 5 V, and the outputs are at 0 V. When a key is pressed, I110 activates interrupt (I2CINT-line goes to zero), and the radio scans the keyboard matrix until it locates the pressed key. Each of the outputs P0...P2 (I220) alternates between 5 V and 0 V, and the states are read via I110.

11.0.5.1 Display

I100 is an I2C path-controlled display control-circuit. It controls the LCD- display directly with 44 outputs. The display is 4/1-multiplexed. There are 4x40 (=160) individually controlled LCD segments.

R103 determines the multiplexing frequency, and R100-R102 provide LCD temperature compensation.

11.0.5.2 Power Supply

I261 is a 5 V regulator, which drops the 9 V voltage coming from the radio to a 5 V voltage for logic circuits. There is separate regulator for LCD: D264, which provides a voltage of 5.6 V (the temperature compensation requires more than 5 V).

11.0.5.3 Parts list

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
AD4629	A100	Benefon LCD I	46x29mm 6xalpha,10x7seg+6	Phi/Varitr	LP-1707-B (=Ph)
AEE004	A207				
AMY063	A223	Microphone Omnidirectio	-42-+3dB	Matsushita	WM-060AY
CC0223	C102	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0223	C110	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0223	C120	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0223	C130	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0101	C134	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0101	C139	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0473	C206	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CB0224	C210	SMD capasitor	220 nF 20% 50 V X7R	Philips	
CU0105	C216	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CU0106	C221	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R
CC0680	C222	SMD capasitor	68 pF 5% 50 V NP0	Philips	
CD0101	C223	SMD capasitor	100 pF 5% 50 V NP0	Philips	
CC0473	C224	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0392	C226	SMD capasitor	3.9 nF 10% 50 V X7R	Philips	
CC0680	C227	SMD capasitor	68 pF 5% 50 V NP0	Philips	
CC0473	C228	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C232	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0331	C242	SMD capasitor	330 pF 5% 50 V NP0	Philips	
CB0224	C248	SMD capasitor	220 nF 20% 50 V X7R	Philips	
CU0105	C251	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CU0106	C260	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R
CC0473	C261	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CU0106	C262	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R
CC0473	C264	SMD capasitor	47 nF 10% 50 V X7R	Philips	
DLG050	D141	SMD led	Green	Citizen	CL-50G-CD
DLG050	D142	SMD led	Green	Citizen	CL-50G-CD
DLG050	D143	SMD led	Green	Citizen	CL-50G-CD
DLG050	D144	SMD led	Green	Citizen	CL-50G-CD
DLG050	D145	SMD led	Green	Citizen	CL-50G-CD
DLG050	D146	SMD led	Green	Citizen	CL-50G-CD
DLG050	D151	SMD led	Green	Citizen	CL-50G-CD
DLG050	D152	SMD led	Green	Citizen	CL-50G-CD
DLG050	D153	SMD led	Green	Citizen	CL-50G-CD
DLG050	D154	SMD led	Green	Citizen	CL-50G-CD
DLG050	D155	SMD led	Green	Citizen	CL-50G-CD
DLG050	D156	SMD led	Green	Citizen	CL-50G-CD
DLG050	D157	SMD led	Green	Citizen	CL-50G-CD
DLG050	D158	SMD led	Green	Citizen	CL-50G-CD
DLG050	D159	SMD led	Green	Citizen	CL-50G-CD
DLG050	D160	SMD led	Green	Citizen	CL-50G-CD
DLG050	D161	SMD led	Green	Citizen	CL-50G-CD
DLG050	D162	SMD led	Green	Citizen	CL-50G-CD
DLG050	D163	SMD led	Green	Citizen	CL-50G-CD
DLG050	D164	SMD led	Green	Citizen	CL-50G-CD
DLY050	D171	SMD led	Yellow	Citizen	CL-50Y-CD
DLG050	D173	SMD led	Green	Citizen	CL-50G-CD
DLR050	D175	SMD led	Red	Citizen	CL-50UR-CD
DLY050	D177	SMD led	Yellow	Citizen	CL-50Y-CD
DLY050	D179	SMD led	Yellow	Citizen	CL-50Y-CD
DLY050	D181	SMD led	Yellow	Citizen	CL-50Y-CD
DZ0569	D221	SMD zener	5V6 5% 300mW	Philips	BZX84C5V6
DZ0569	D264	SMD zener	5V6 5% 300mW	Philips	BZX84C5V6
II8576	I100	LCD driver	160-segment I2C	Philips	PCF8576T
II8574	I110	8 bit I/O	I2C	Philips	PCF8574T

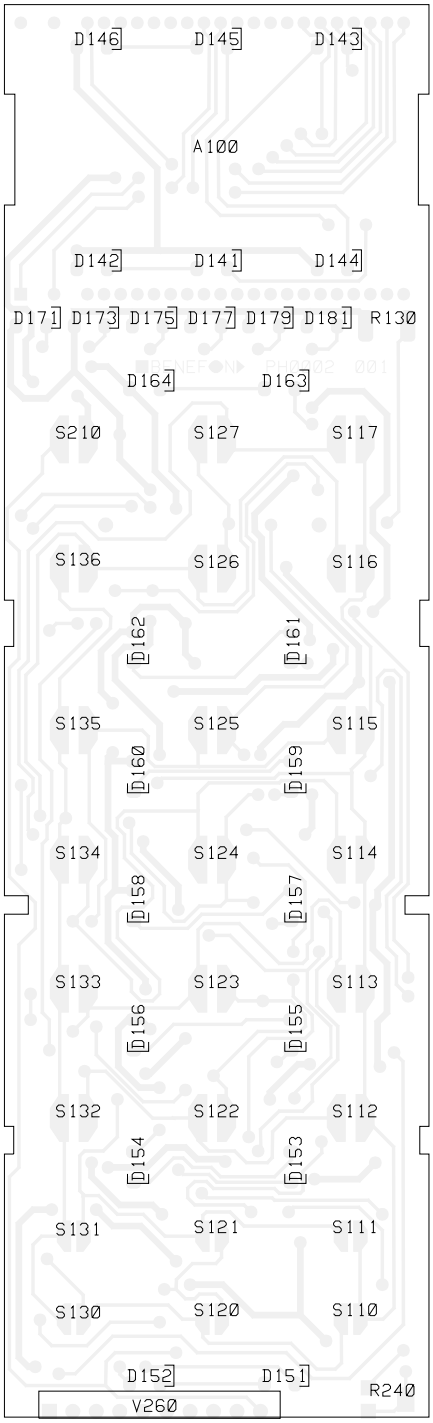
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
II8574	I120	8 bit I/O	I2C	Philips	PCF8574T
II8574	I130	8 bit I/O	I2C	Philips	PCF8574T
IA0272	I135\	2 x op.amp.	LinCMOS Low noise,power	Texas	TLC27M2ID
IH4066	I202\	4xbilateral switch	HCMOS	RCA	74HC4066B
IA3182	I206\	2xop.amp.	Low power,jfet input	Motorola	MC 33182D
IA3182	I228\	2xop.amp.	Low power,jfet input	Motorola	MC 33182D
IH4066	I230\	4xbilateral switch	HCMOS	RCA	74HC4066B
IR2951	I261	Regulator	100mA 5V adj. 5%	National	LP2951CM
PH0002	PCB	PCB handset	46.0 x 153 x 1.6 FR4 (x4pcs)		
QS0051	Q132	SMD transistor	PNP 1.5A/45V	Philips	BCX 51
QSC849	Q148	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q150	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QS0054	Q151	SMD transistor	NPN 1.5A/45V	Philips	BCX 54
QSC849	Q170	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q172	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q174	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q176	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q178	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q180	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q201	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q236	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q246	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q271	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
RTN153	R100	SMD-NTC resistor	15k 5% 3.7%/C	Hokuriku	
RC0562	R101	SMD resistor	5.6 k 5% 0.125 W	Kamaya	
RC0332	R102	SMD resistor	3.3 k 5% 0.125 W	Kamaya	
RC0184	R103	SMD resistor	180 k 5% 0.125 W	Kamaya	
RC0102	R104	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0102	R105	SMD resistor	1 k 5% 0.125 W	Kamaya	
RTL678	R130	LDR-SMD resistor	50-200k...5M	Moririca	MKY-54L678
RC0103	R131	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0104	R132	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R133	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R134	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0102	R135	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0153	R136	SMD resistor	15 k 5% 0.125 W	Kamaya	
RC0104	R137	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0473	R138	SMD resistor	47 k 5% 0.125 W	Kamaya	
RC0105	R139	SMD resistor	1 M 5% 0.125 W	Kamaya	
RC0221	R141	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0221	R143	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0221	R145	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0103	R147	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0102	R148	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0103	R149	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0102	R150	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0271	R151	SMD resistor	270 R 5% 0.125 W	Kamaya	
RC0271	R153	SMD resistor	270 R 5% 0.125 W	Kamaya	
RC0331	R155	SMD resistor	330 R 5% 0.125 W	Kamaya	
RC0331	R157	SMD resistor	330 R 5% 0.125 W	Kamaya	
RC0331	R159	SMD resistor	330 R 5% 0.125 W	Kamaya	
RC0221	R161	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0271	R163	SMD resistor	270 R 5% 0.125 W	Kamaya	
RC0222	R165	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0103	R170	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0391	R171	SMD resistor	390 R 5% 0.125 W	Kamaya	
RC0103	R172	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0391	R173	SMD resistor	390 R 5% 0.125 W	Kamaya	
RC0103	R174	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0391	R175	SMD resistor	390 R 5% 0.125 W	Kamaya	

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
RC0103	R176	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0391	R177	SMD resistor	390 R 5% 0.125 W	Kamaya	
RC0103	R178	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0391	R179	SMD resistor	390 R 5% 0.125 W	Kamaya	
RC0103	R180	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0391	R181	SMD resistor	390 R 5% 0.125 W	Kamaya	
RC0104	R200	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0393	R201	SMD resistor	39 k 5% 0.125 W	Kamaya	
RC0103	R205	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0103	R206	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0102	R207	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0153	R209	SMD resistor	15 k 5% 0.125 W	Kamaya	
RC0104	R210	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0153	R211	SMD resistor	15 k 5% 0.125 W	Kamaya	
RC0104	R215	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R216	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0102	R220	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0272	R221	SMD resistor	2.7 k 5% 0.125 W	Kamaya	
RC0184	R224	SMD resistor	180 k 5% 0.125 W	Kamaya	
RC0183	R225	SMD resistor	18 k 5% 0.125 W	Kamaya	
RC0224	R226	SMD resistor	220 k 5% 0.125 W	Kamaya	
RC0153	R227	SMD resistor	15 k 5% 0.125 W	Kamaya	
RC0222	R231	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0184	R232	SMD resistor	180 k 5% 0.125 W	Kamaya	
RC0104	R235	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0393	R236	SMD resistor	39 k 5% 0.125 W	Kamaya	
RC0393	R238	SMD resistor	39 k 5% 0.125 W	Kamaya	
RC0103	R239	SMD resistor	10 k 5% 0.125 W	Kamaya	
RI0203	R240	SMD trimmer resistor	20k 20% 0.25W	Copal	ST-4A
RC0333	R241	SMD resistor	33 k 5% 0.125 W	Kamaya	
RC0184	R242	SMD resistor	180 k 5% 0.125 W	Kamaya	
RC0104	R245	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0393	R246	SMD resistor	39 k 5% 0.125 W	Kamaya	
RC0104	R248	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R250	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R251	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0103	R255	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0101	R256	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0101	R257	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0101	R258	SMD resistor	100 R 5% 0.125 W	Kamaya	
RC0222	R264	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RC0104	R270	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R271	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0103	R272	SMD resistor	10 k 5% 0.125 W	Kamaya	
000000	S110				
000000	S111				
000000	S112				
000000	S113				
000000	S114				
000000	S115				
000000	S116				
000000	S117				
000000	S120				
000000	S121				
000000	S122				
000000	S123				
000000	S124				
000000	S125				
000000	S126				
000000	S127				

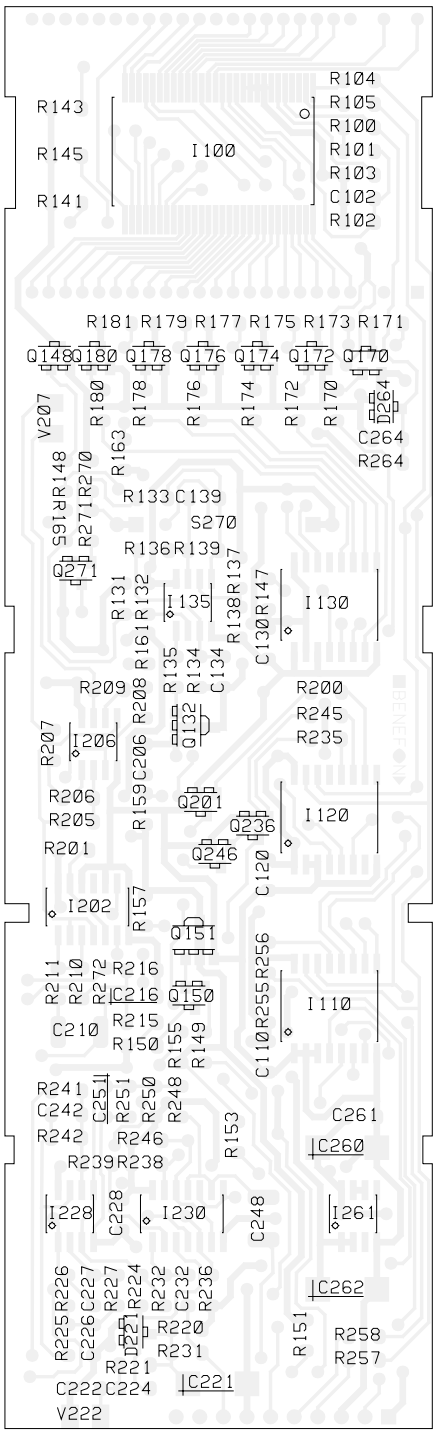
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
000000	S130				
000000	S131				
000000	S132				
000000	S133				
000000	S134				
000000	S135				
000000	S136				
000000	S210				
AR0014	S270	Reed switch	15-20AT l=14.2 mm	Philips	RI-27AA
000000	V207				
000000	V222				
VM0110	V260	Contact strip angle	1 x 10	NB-electr.	PH3-10-10G

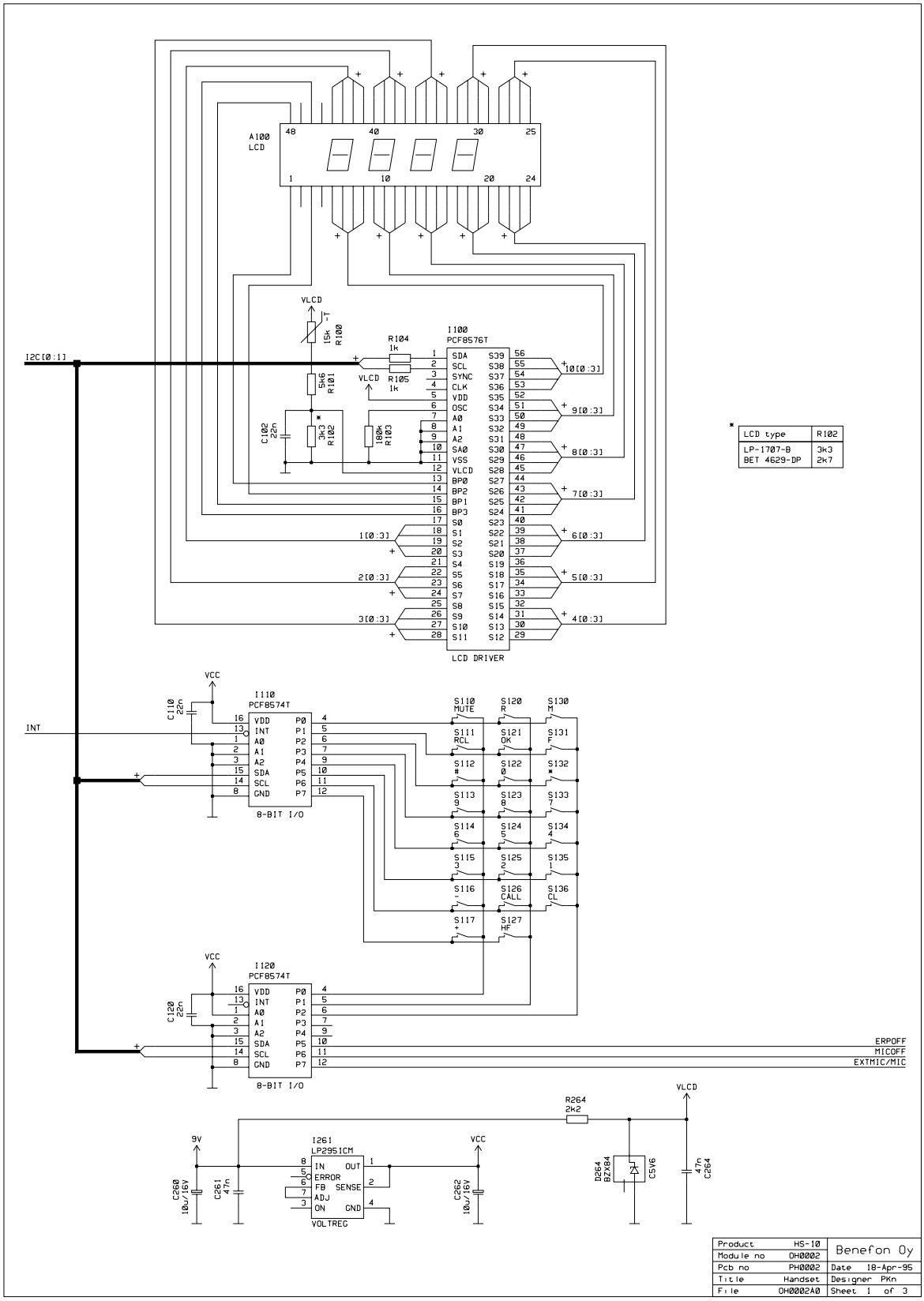
Last update 18.04.95

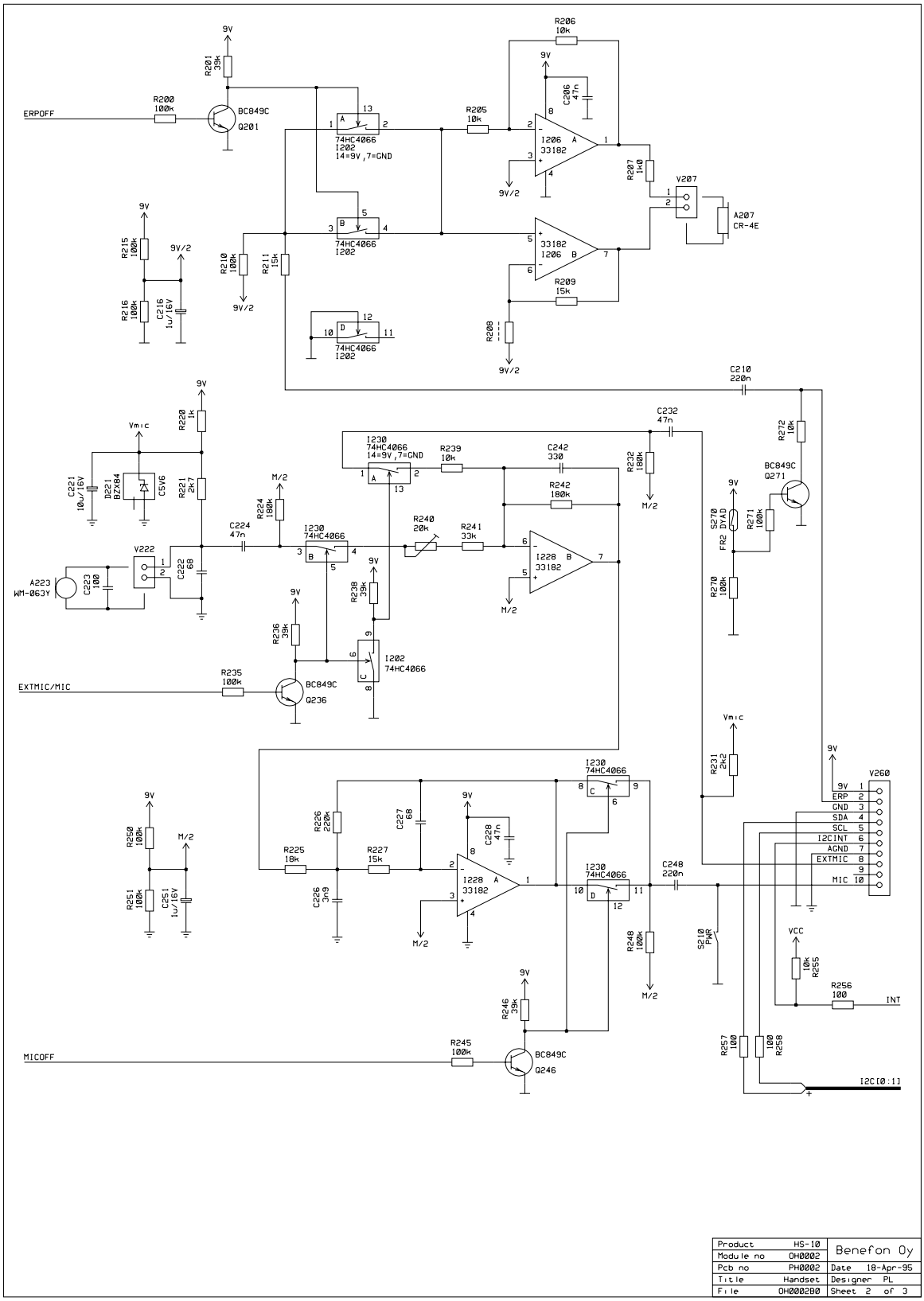
Component Side Layout PH0002A0 (Schematic OH0002A-C0)

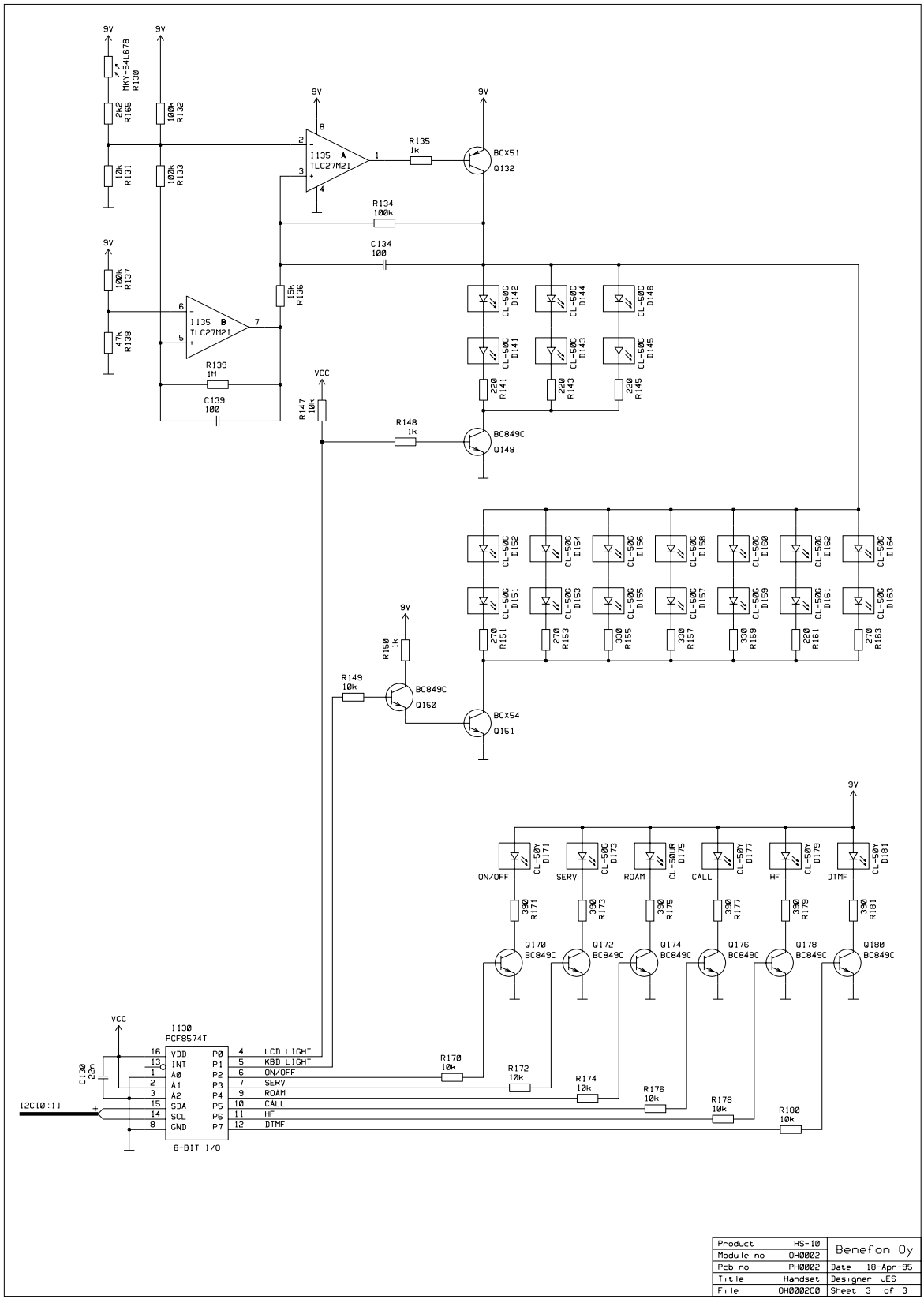


Solder Side Layout PH0002A0 (Schematic OH0002A-C0)




A100
LCD
VLCD
R100
15k -T
R104
1k
R105
1k
R101
5k6
R102
3k3
C102
22n
R103
180k
I100
PCF8576T
SDA
SCL
SYNC
CLK
VDD
OSC
A0
A1
A2
SA0
VSS
VLCD
BP0
BP2
BP1
BP3
LCD DRIVER
I2C[0:1]
10[0:3]
9[0:3]
8[0:3]
7[0:3]
6[0:3]
5[0:3]
4[0:3]
1[0:3]
2[0:3]
3[0:3]
LCD type | R102
LP-1707-B | 3k3
BET 4629-DP | 2k7
INT
VCC
C110
22n
I110
PCF8574T
VDD
INT
A0
A1
A2
SDA
SCL
GND
P0
P1
P2
P3
P4
P5
P6
P7
8-BIT I/O
S110 MUTE
S120
S130
S111 RCL
S121 OK
S131
S112 #
S122 0
S132 *
S113 9
S123 8
S133 7
S114 6
S124 5
S134 4
S115 3
S125 2
S135 1
S116 .
S126 CALL
S136 CL
S117 +
S127 HF
C120
22n
I120
PCF8574T
ERPOFF
MICOFF
EXTMIC/MIC
R264
2k2
9V
I261
LP2951CM
IN
OUT
ERROR
FB
SENSE
ADJ
ON
GND
VOLTREG
C260
10u/16V
C261
47n
C262
10u/16V
D264
BZX84
C5V6
C264
47n
Product HS-10
Module no OH0002
Pcb no PH0002
Title Handset
File OH0002A0
Benefon Oy
Date 18-Apr-95
Designer PKn
Sheet 1 of 3


ERPOFF
EXTMIC/MIC
MICOFF
Vmic
9V
9V/2
M/2
VCC
INT
I2C[0:1]
74HC4066
BC849C
Product HS-10
Module no OH0002
Pcb no PH0002
Title Handset
File OH0002B0
Benefon Oy
Date 18-Apr-95
Designer PL
Sheet 2 of 3


9V
MKY-54L678 R130
2k2 R165
100k R132
10k R131
100k R133
I135 A TLC27M21
R135 1k
BCX51 Q132
R134 100k
C134 100
100k R137
47k R138
I135 B TLC27M21
15k R136
R139 1M
C139 100
VCC
R147 10k
R148 1k
BC849C Q148
CL-50G D142
CL-50G D144
CL-50G D146
CL-50G D141
CL-50G D143
CL-50G D145
220 R141
220 R143
220 R145
CL-50G D152
CL-50G D154
CL-50G D156
CL-50G D158
CL-50G D160
CL-50G D162
CL-50G D164
CL-50G D151
CL-50G D153
CL-50G D155
CL-50G D157
CL-50G D159
CL-50G D161
CL-50G D163
270 R151
270 R153
330 R155
330 R157
330 R159
220 R161
270 R163
R150 1k
R149 10k
BC849C Q150
BCX54 Q151
CL-50Y D171
CL-50G D173
CL-50UR D175
CL-50Y D177
CL-50Y D179
CL-50Y D181
ON/OFF
SERV
ROAM
CALL
HF
DTMF
390 R171
390 R173
390 R175
390 R177
390 R179
390 R181
Q170 BC849C
Q172 BC849C
Q174 BC849C
Q176 BC849C
Q178 BC849C
Q180 BC849C
I130 PCF8574T
C130 22n
I2C[0:1]
VDD
INT
A0
A1
A2
SDA
SCL
GND
P0
P1
P2
P3
P4
P5
P6
P7
LCD LIGHT
KBD LIGHT
ON/OFF
SERV
ROAM
CALL
HF
DTMF
R170 10k
R172 10k
R174 10k
R176 10k
R178 10k
R180 10k
8-BIT I/O
Product HS-10
Module no OH0002
Pcb no PH0002
Title Handset
File OH0002C0
Benefon Oy
Date 18-Apr-95
Designer JES
Sheet 3 of 3

12.0 DATA-INTERFACE FUNCTION OUTLINE

OO0402

The data-interface can be divided into three functional parts: the processor, audio, and ring and line voltage circuits. Circuit diagrams are also separated into these three sections.

12.0.1 The Processor

The processor function is provided by I010 MC68HC11 chip, which uses a 3.57 MHz crystal X010. Program memory is provided by 64k*8 EPROM I030. Program memory and external I/O circuit address coding is performed by I050 and I060.

Communication between the processor and the radio unit uses an IIC-bus connected to I070, I080, I090 and I100. Each chip is connected to the processor data-bus with latch circuit.

The battery supported IIC-RAM I120 is connected to the processor IIC bus. The circuit is set to "power-saving" mode by inverting the regulator I001 ERROR output with Q121.

The DTMF receiver I040 interprets codes sent from the tele-VDU and feeds them to the processor through the I/O port. The oscillator I040 input is connected to the processor's oscillator output.

The logical +5V power supply is regulated by I001, the ERROR output of which is used to reset the processor.

12.0.2 Memory Addresses

I030 EPROM	8000H - FFFFH	program memory
I071 LATCH	4000H	keyboard (input)
1081 LATCH	5000H	indicator values
I091 LATCH	6000H	tariff rate reception
I110 LATCH	7000H	keyboard (output)
CPU inc. RAM	OOH - FFH	

12.0.3 Interrupts

The DTMF-receiver I040 StD output is activated by the circuit detecting a DTMF signal. This generates an "input capture" timer-interrupt to processor I010 (PAO/IC3).

Keyed in numeric codes (inc. * and #) are saved in the number buffer, with room for 23 digits. As the number buffer becomes full, further input is ignored.

The first DTMF code received suppresses the dialling tone by grounding the audio frequency generator processor pins PA5/OC4, PA5/OC3 and PA6/OC2. A DTMF interrupt activates a 7 second timer which will also display "number ready" mode.

The system clock's interrupt interval is 9.15424 ms. The clock updates the SW counters, which are used for timing functions, dialling-tone formation (call, dial, busy), and directing the adapter transfer modes.

The timer PA5/OC3 is used to generate a 25 Hz call tone. The relevent frequency half-cycle is loaded into register TOC3; pin OC3 connected as the output pin (TCTL1 register); the OC3 interrupt flag is nullified in register RFLG1 and an interrupt is allowed by activating the relevant interrupt-bit in register TMSK1.

When the ouput-compare register corresponds to the reference clock value, the interrupt is completed and a new half-cycle reading is loaded into register TOC3. The output square-wave is of 25 Hz frequency. Call-tone duration is governed by the above mentioned system-clock interrupts from the synchronised SW counters.

Dialling- and busy-tones are formed using PA4/PC4 output. The frequency in both cases is 425 Hz. Busy-tone cycle is 300/300 ms. Tone generation is similar to the process described above. (Dialling-tone is not broken by the SW counters). The PA6/OC2 output is reserved for generation of a tariff-pulse (16 kHz). This is not in use with the data-interface.

12.0.4 Processor I/O Functions

During an input-capture interrupt, DTMF data is read from gate E pins PE0 ... PE3.

EXAL (incoming call) is registered at E gate pin PE4.

TERMHOOK (accessory hook) is registered at gate A pin PA2.

IN USE (PD3) control activates the data-interface and prevents simultaneous operation of tele-VDU and accessories.

RING GATE (PD5) - 120V regulator required for data-interface call functions.

IIC RAM circuit I120 data and clock (PA7, PF4). Included is a pulse counter for use with the coin-operated version. The data-interface uses this circuit to store call data (ACALL and BCALL data).

In case of a power failure with the adapter in call-mode, the RAM memory will be checked after reset, and operation will continue as before. If the call was terminated before reset, then the adapter will function normally, switching to dial-mode when the handset is lifted.

IIC LATCH ENABLE (PD0). Control for latch circuit I110. The circuit is used to transfer a key-code to the radio unit. IIC-interrupt to the radio is simulated as follows: key-in the required code to the latch circuit I110, de-activate the PD0 control and wait until the latch circuit I071 can be read by the radio prompted keyboard scan. For each scan, the relevant code is written via PD0-control to I110. Finally, the corresponding key release interrupt is simulated.

Call-mode is recognised by reading the CALL-led state from circuit I081. Continuous illumination of the led for one second during calibration indicates call-mode.

12.0.5 Audio

The telephone connection branch is formed by the operational amplifier I215. The branch is matched to 820R/38 nF line impedance with resistors R218, R219 and condensator C218. The telephone line, with +- 3.0 kHz deviation (1 kHz) and 3/7 loudness (400 mVrms), has a 600 Ohm resistive load with a -28 dBm signal level. Similarly, a -3dBm input level will provide 1.0 Vrms in the TXAUDIO line, with +- 3.0 kHz deviation in the transmitter.

Audio tones (425 Hz) are filtered with the operational amplifier I205A, and then fed through the branch to the telephone line.

Tariff pulses (12/16 kHz) are filtered with the operational amplifiers I235A, and are fed to the standard current modulated telephone line.

The telephone line includes a return-feed constant current integrator I235, Q250, and Q251, to provide the telephone line loop current. The constant current load maintains the loop current supply without any loss of audio signal.

Loop current switching is detected from the transistor Q265 constant current load emitter surplus potential.

12.0.6 Ring- And Line-voltage Power Supply

The telephone connection line-potential (60 V) is derived from a current form flyback power supply.

During operation, the control-circuit I341 measures the current flowing through the transformer primary windings at resistor R338. When the current exceeds the value specified by the control circuit, FET Q335 is de-activated. This results in the energy stored in the transformer being discharged from the secondary windings through diode D328 to output condensators C329 and C328. When the output drops to the value determined by resistors F342 and R343, the control circuit lowers the level at which FET Q335 switches.

With RING-GATE control, offset-current is directed to the control circuit adjuster through resistor R347, resulting in an output voltage of 120V during the ring.

The secondary current is limited with operational amplifier I205B, which measures the transformer secondary current flowing through resistor R371, and when secondary current limit is exceeded 1205B adjusts the control-circuit 1341 via diode D367.

RING-control is normally in 0-state, and Q325 functions as a constant-current generator, providing a continuous voltage for FET Q323. This causes Q323 to conduct, and the line-voltage is fed to the telephone line. During a call, RING-line alternates between 1 and 0 at 25Hz, causing Q323 and Q326 to conduct in turn. As the power-supply voltage is raised to 120V in call-mode, the telephone line is provided with both 60V DC and 60V AC voltages.

The audio signals are changed with relay A315 to the branch circuit with IN-USE control. The diode D303 allows radio unit to be switched off if for some reason the call cannot be terminated from the VDU. FET Q317 breaks the SDA-line, so that the keyboard is inoperative while the tele-VDU is in use. The display functions as normal as the diode D303 will permit writing to the screen.

12.0.7 Parts list

OO0402

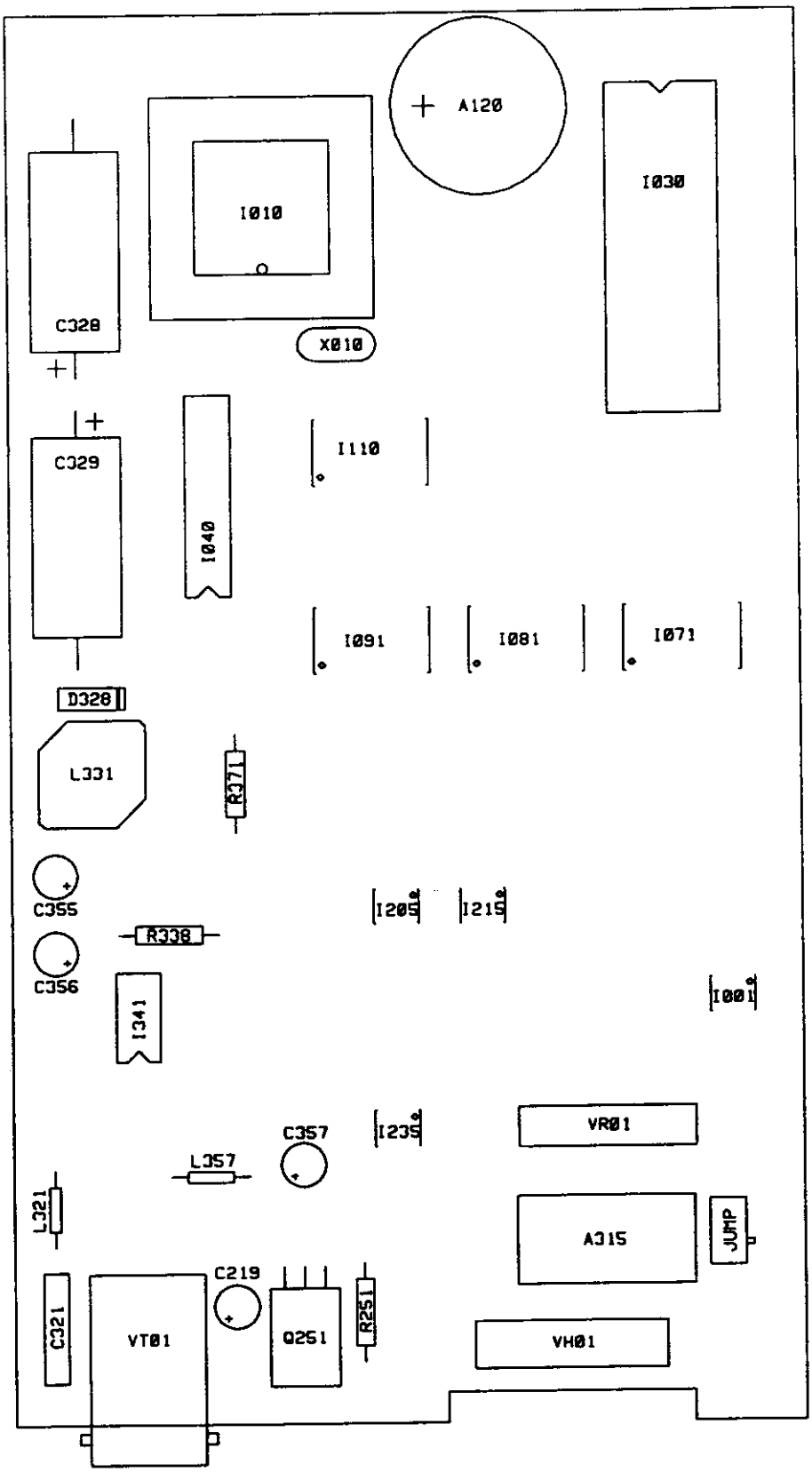
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
AB0003	A120	Lithium battery	3V 180mAh d=20mm	Matsushita	BR2032-1HG
AR0004	A315\	Relay	9V/1.25A	Takamisawa	RA-9W-K
CC0473	C001	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C002	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CU0106	C003	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R
CC0473	C010	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0220	C011	SMD capasitor	22 pF 5% 50V NP0	Philips	
CC0220	C012	SMD capasitor	22 pF 5% 50V NP0	Philips	
CC0473	C020	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C030	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C040	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C041	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0102	C044	SMD capasitor	1 nF 5% 50V NP0	Philips	
CC0473	C045	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C050	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C060	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C070	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C071	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C080	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C081	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C090	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C091	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C100	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C110	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0393	C203	SMD capasitor	39 nF 10% 50V X7R	Philips	
CC0393	C205	SMD capasitor	39 nF 10% 50V X7R	Philips	
CB0224	C212	SMD capasitor	220 nF 20% 50 V X7R	Philips	
CC0332	C215	SMD capasitor	3.3 nF 5% 50 V NP0	Philips	
CC0393	C218	SMD capasitor	39 nF 10% 50V X7R	Philips	
CE0106	C219	Al elko	10 uF/35 V 5x7mm	Philips	2222 097 50109
CB0224	C226	SMD capasitor	220 nF 20% 50 V X7R	Philips	
CC0102	C233	SMD capasitor	1 nF 5% 50V NP0	Philips	
CC0102	C235	SMD capasitor	1 nF 5% 50V NP0	Philips	
CC0152	C241	SMD capasitor	1.5 nF 5% 50V NPO	Philips	
CC0102	C245	SMD capasitor	1 nF 5% 50V NP0	Philips	
CU0105	C254	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0683	C263	SMD capasitor	68nF/50V/10%/X7R		
CC0103	C267	SMD capasitor	10 nF 10% 50V X7R	Philips	
CU0105	C282	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CP0683	C321	Polypropylen	68nF/250/160V	Evox	PMR10
CE0226	C328	Al elko	22 uF/160V 25x10mm	Philips	222204131229
CE0226	C329	Al elko	22 uF/160V 25x10mm	Philips	222204131229
CC0103	C333	SMD capasitor	10 nF 10% 50V X7R	Philips	
CC0471	C339	SMD capasitor	470 pF 5% 50 V NP0	Philips	
CC0101	C345	SMD capasitor	100 pF 5% 50V NP0	Philips	
CC0152	C352	SMD capasitor	1.5 nF 5% 50V NPO	Philips	
CC0473	C353	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CE0337	C355	Al elko	330uF/16V 20% 15x7.3mm	Philips	222213555331
CE0337	C356	Al elko	330uF/16V 20% 15x7.3mm	Philips	222213555331
CE0337	C357	Al elko	330uF/16V 20% 15x7.3mm	Philips	222213555331
CC0473	C373	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C375	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C376	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C378	SMD capasitor	47 nF 10% 50 V X7R	Philips	

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
DS0070	D120	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DS0099	D219	SMD diode	70 V 200 mA	Philips	BAV 99
DY0074	D303	Shottky diode		Philips	BAT 74
DS0070	D315	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DF0026	D328	Diode (very fast)	1A/400V 30ns	Philips	BYV 26B
DS0070	D361	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DS0070	D367	SMD diode pair	70V/100mA common cathode	Philips	BAV 70
DS0099	D373	SMD diode	70 V 200 mA	Philips	BAV 99
IR2951	I001	Regulator	100mA 5V adj. 5%	National	LP2951CM
IP6811	I010	8-BIT MIKROPROS	512 EEPROM, 8A/D, no ROM	Motorola	MC68HC11A1FN
IH0573	I020	Octal D-latches	HCMOS		74HC573
IM7512	I030	One time prom CMOS	65.536 x 8b 200ns	Fujitsu	MBM27C512P-20P
IA8870	I040	DTMF decoder		Plessey	MV8870
IH0138	I050	3 to 8-line decod. inv.	HCMOS	RCA	74HC138
IH0002	I060\	4x2-inp.NOR	HCMOS		74HC02
II8574	I070	8 bit I/O	I2C	Philips	PCF8574T
IH0573	I071	Octal D-latches	HCMOS		74HC573
II8574	I080	8 bit I/O	I2C	Philips	PCF8574T
IH0573	I081	Octal D-latches	HCMOS		74HC573
II8574	I090	8 bit I/O	I2C	Philips	PCF8574T
IH0573	I091	Octal D-latches	HCMOS		74HC573
II8574	I100	8 bit I/O	I2C	Philips	PCF8574T
IH0573	I110	Octal D-latches	HCMOS		74HC573
II8570	I120	SRAM	I2C 256x8bit	Philips	PCF8570T
IA3182	I205\	2xop.amp.	Low power,jfet input	Motorola	MC 33182D
IA0204	I215\	Dual operational amp.	High performance	SGS	LS204M
IA0272	I235\	2 x op.amp.	LinCMOS Low noise,power	Texas	TLC27M2ID
IX2843	I341	Current mode controller		Motorola	UC2843AN
LA0106	L321	Inductor 9.5x4mm	10uH+-10% 0.34A Q=55(8MHz)	Dale	
LT0001	L331	Transformer	DRW NO 2/90	Salcomp	RM5 SCP7801
LA0105	L357	Incuctor 9.5x4mm	1uH-+10% 0.9A Q=50(25MHz)	Dale	
VI0028	MEC1	IC -socket	DIL-28		
VI0052	MEC2	IC - socket	PLCC-52 1R piikit	Methode	
NI3065	MEC3	Snap rivet (pikaniitti)	Nylon 6, RMS-28	Richco	SR 3065B
PO0003	PCB	PCB data-adapter	190 x 161,5mm FR4 (2x)	Benefon	
QSC849	Q121	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q250	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QP0158	Q251	Medium power transistor	NPN 0.5A/300V 20W	Motorola	BD 158
QSC849	Q265	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q306	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC849	Q311	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QF0003	Q317	SMD n-channel FET	60V/0.75A Rds 3.2	I&R	IRFS 1Z3
QF9210	Q323	SMD p-channel FET	200V/2A Rds=3	I&R	IRFR 9210
QS0040	Q325	SMD transistor	NPN 1A/250V	Philips	BST40
QS0040	Q326	SMD transistor	NPN 1A/250V	Philips	BST40
QF0024	Q335	SMD n-channel	60V/15A/Rds=0.1	I&R	IRFR024
QSC849	Q370	SMD transistor	NPN 0.2A/30V F=1.2dB	Philips	BC 849 C
QSC859	Q371	SMD transistor	PNP 0.2A/30V F=1.2dB	Philips	BC 859 C
RC0223	R002	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0105	R010	SMD resistor	1 M 5% 0.125 W	Kamaya	
RC0104	R011	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0103	R012	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0103	R013	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0684	R041	SMD resistor	680 k 5% 0.125 W	Kamaya	
RC0223	R044	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0104	R045	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R070	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R120	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0334	R121	SMD resistor	330 k 5% 0.125 W	Kamaya	
RC0472	R123	SMD resistor	4.7 k 5% 0.125 W	Kamaya	

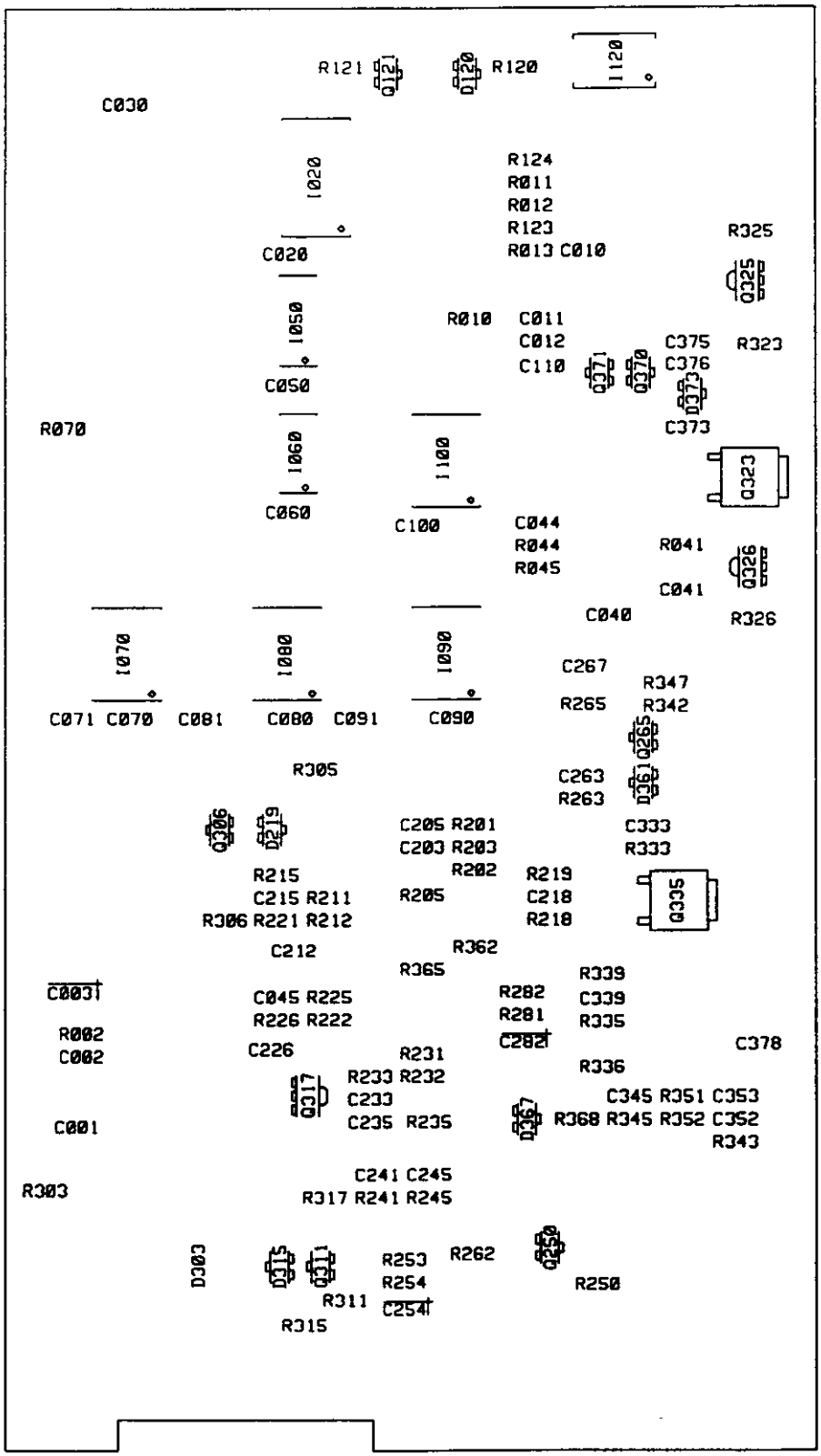
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
RC0472	R124	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0334	R201	SMD resistor	330 k 5% 0.125 W	Kamaya	
RC0121	R202	SMD resistor	120 R 5% 0.125 W	Kamaya	
RC0470	R203	SMD resistor	47 R 5% 0.125 W	Kamaya	
RC0564	R205	SMD resistor	560 k 5% 0.125 W	Kamaya	
RC0472	R211	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0333	R212	SMD resistor	33 k 5% 0.125 W	Kamaya	
RC0183	R215	SMD resistor	18 k 5% 0.125 W	Kamaya	
RC0102	R218	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0682	R219	SMD resistor	6.8 k 5% 0.125 W	Kamaya	
RC0223	R221	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0223	R222	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0183	R225	SMD resistor	18 k 5% 0.125 W	Kamaya	
RC0221	R226	SMD resistor	220 R 5% 0.125 W	Kamaya	
RC0223	R231	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0682	R232	SMD resistor	6.8 k 5% 0.125 W	Kamaya	
RC0102	R233	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0223	R235	SMD resistor	22 k 5% 0.125 W	Kamaya	
RC0103	R241	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0103	R245	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0472	R250	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RB6809	R251	Metal film resistor	68R 5% 0.4W	Beyschlag	MBA0207-50
RC0104	R253	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0124	R254	SMD resistor	120 k 5% 0.125 W	Kamaya	
RC0103	R262	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0472	R263	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0104	R265	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R281	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0104	R282	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0472	R303	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0103	R305	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0103	R306	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0472	R311	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0000	R315	SMD resistor	0 R	Kamaya	
RC0103	R317	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0103	R323	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0472	R325	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RC0103	R326	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0150	R333	SMD resistor	15 R 5% 0.125 W	Kamaya	
RC0103	R335	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0560	R336	SMD resistor	56 R 5% 0.125 W	Kamaya	
RB0228	R338	Metal film resistor	0.22R 5% 0.4W	Beyschlag	MBA0207-50
RC0102	R339	SMD resistor	1 k 5% 0.125 W	Kamaya	
RC0334	R342	SMD resistor	330 k 5% 0.125 W	Kamaya	
RC0103	R343	SMD resistor	10 k 5% 0.125 W	Kamaya	
RC0104	R345	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0333	R347	SMD resistor	33 k 5% 0.125 W	Kamaya	
RC0682	R352	SMD resistor	6.8 k 5% 0.125 W	Kamaya	
RC0104	R362	SMD resistor	100 k 5% 0.125 W	Kamaya	
RC0224	R365	SMD resistor	220 k 5% 0.125 W	Kamaya	
RC0472	R368	SMD resistor	4.7 k 5% 0.125 W	Kamaya	
RB1000	R371	Metal film resistor	100R 5% 0.4W	Beyschlag	MBA0207-50
VD0016	VH01	D-connector	D-15S 90 ast.kulma	Cannon	DA121073-5044
VM0116	VR01	Contact strip angle	2x8	NB-electr.	H4-6-16G
VP0077	VT01	Modular jack	Right angle 6/4cont.	Molex	90077-1076
X35796	X010	DTMF-quartz crystal	3.579545 MHZ +-30PPM	Meiden	

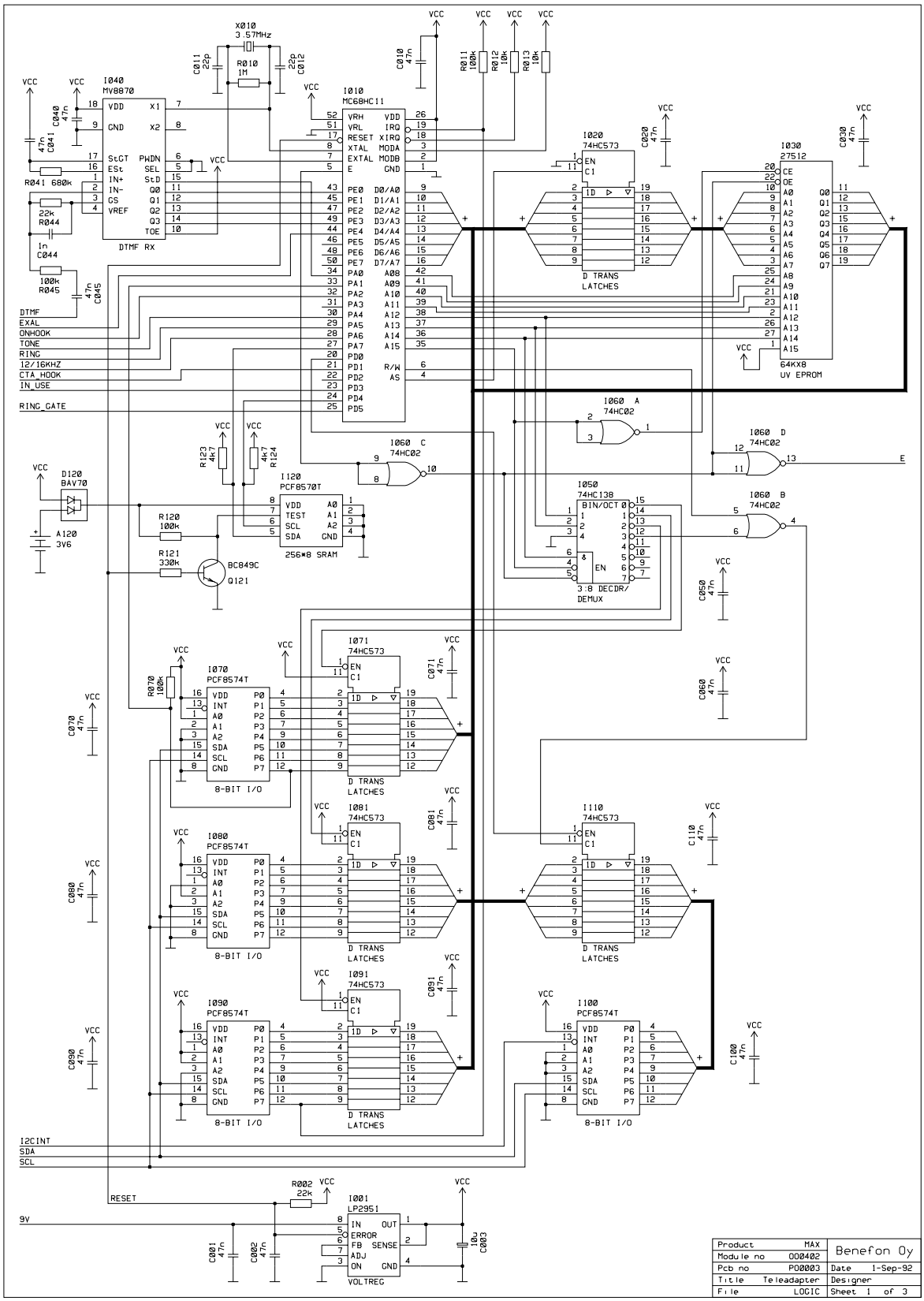
Last
update
01.09.92

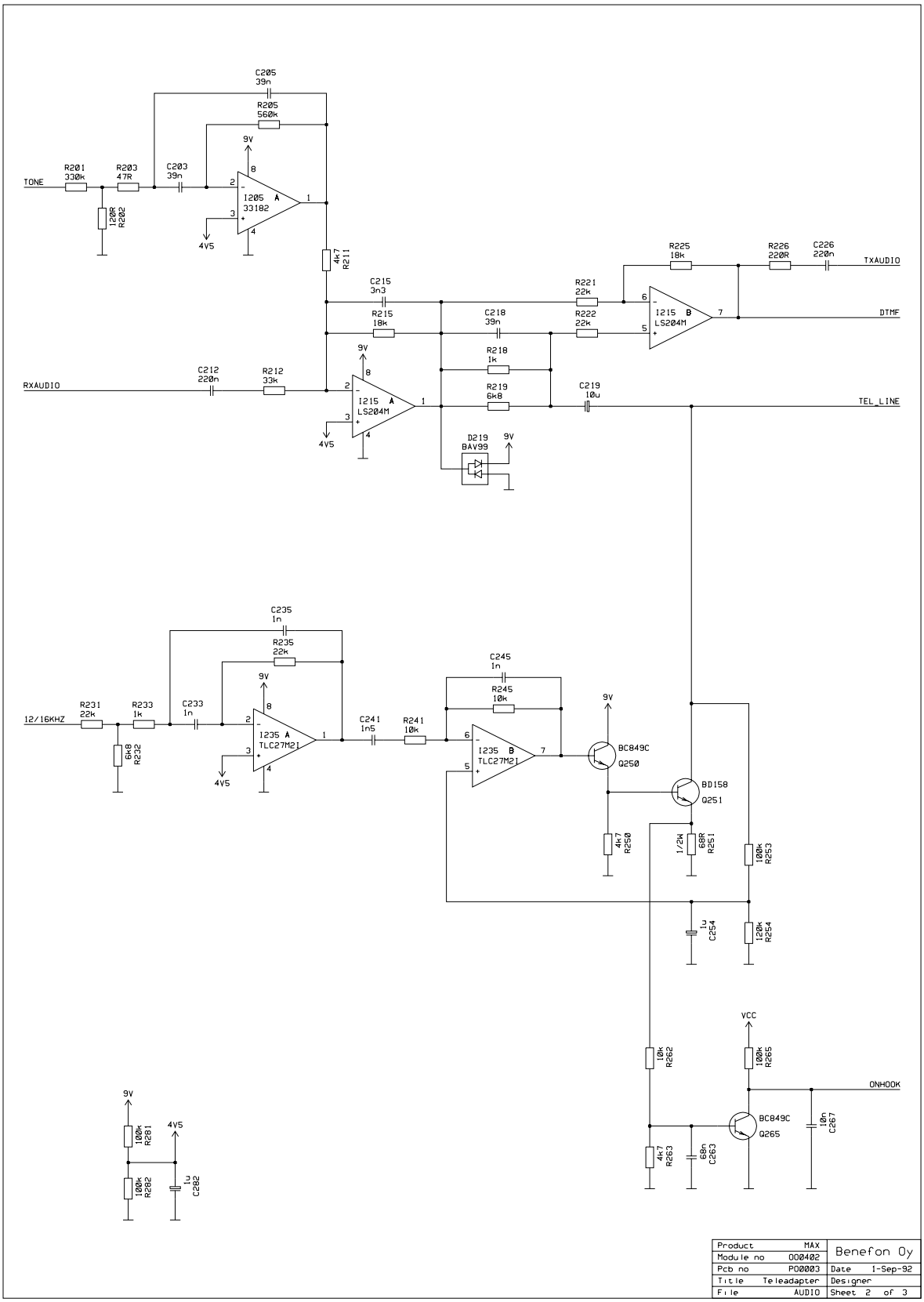
Component Side Layout PO0003A0 (Schematic OO0402A-C0)

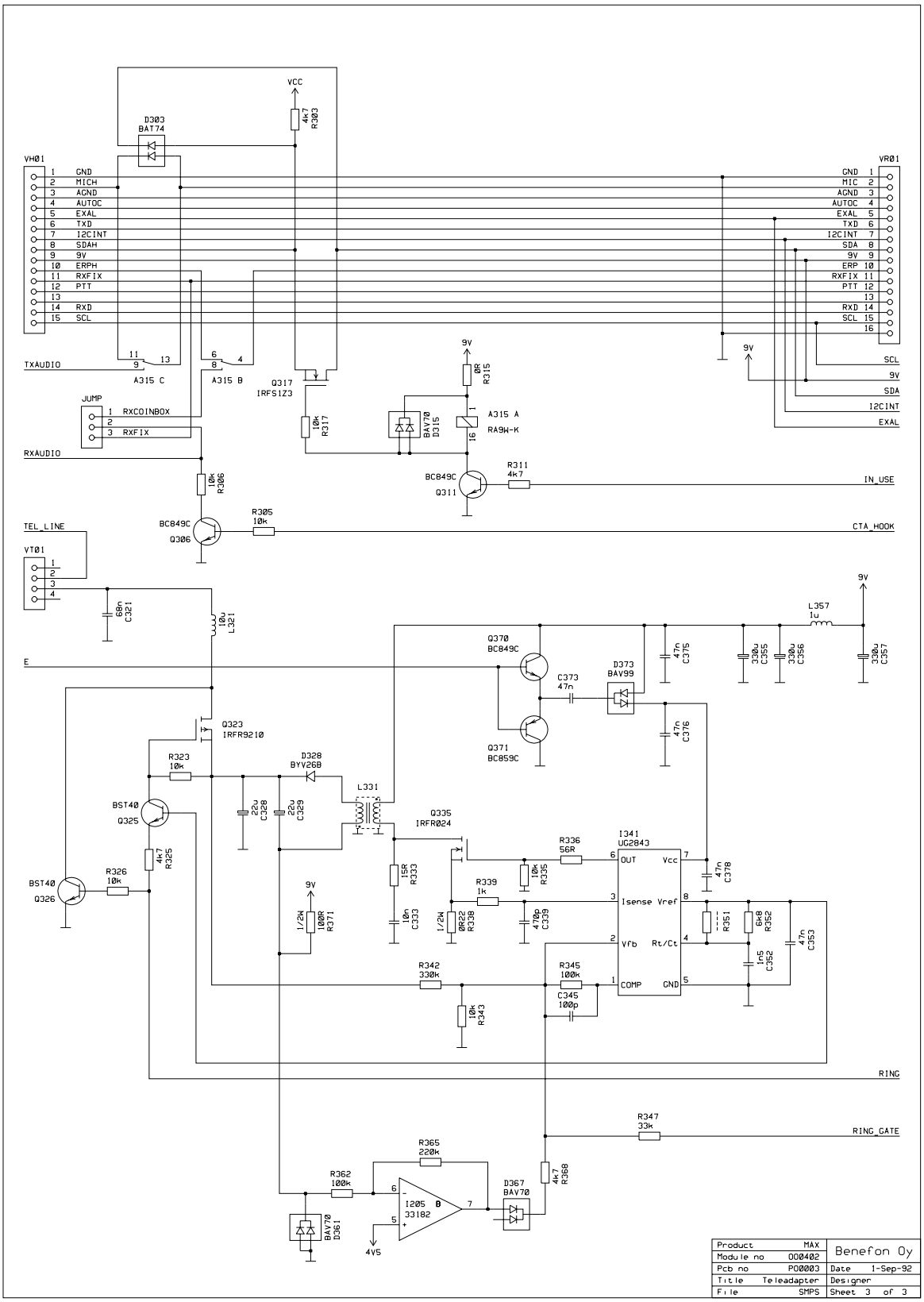


Solder Side Layout PO0003A0 (Schematic OO402A-C0)




I010 MC68HC11
I020 74HC573
I030 27512
64KX8 UV EPROM
I040 MV8870
DTMF RX
I050 74HC138
3:8 DECDR/ DEMUX
I060 A 74HC02
I060 B 74HC02
I060 C 74HC02
I060 D 74HC02
I070 PCF8574T
I071 74HC573
I080 PCF8574T
I081 74HC573
I090 PCF8574T
I091 74HC573
I100 PCF8574T
I110 74HC573
I120 PCF8570T
256*8 SRAM
I001 LP2951
VOLTREG
D TRANS LATCHES
8-BIT I/O
DTMF
EXAL
ONHOOK
TONE
RING
12/16KHZ
CTA_HOOK
IN_USE
RING_GATE
I2CINT
SDA
SCL
RESET
9V
Product MAX
Module no 000402
Pcb no P0003
Title Teleadapter
File LOGIC
Benefon Oy
Date 1-Sep-92
Designer
Sheet 1 of 3

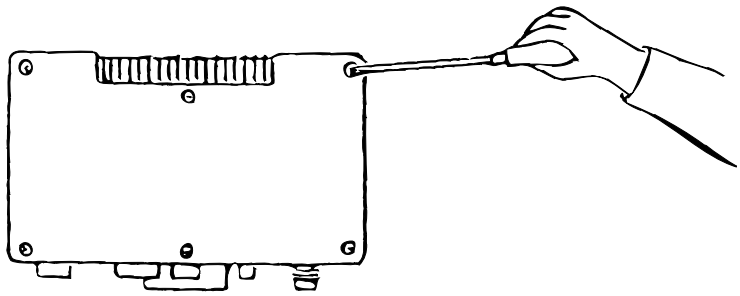

C205 39n
R205 560k
9V
R201 330k
R203 47R
C203 39n
TONE
I205 A 33182
120R R202
4V5
4k7 R211
R225 18k
R226 220R
C226 220n
TXAUDIO
C215 3n3
R221 22k
R215 18k
C218 39n
R222 22k
I215 B LS204M
DTMF
R218 1k
C212 220n
R212 33k
RXAUDIO
I215 A LS204M
R219 6k8
C219 10u
TEL_LINE
D219 BAV99
C235 1n
R235 22k
C245 1n
R245 10k
R231 22k
R233 1k
C233 1n
12/16KHZ
6k8 R232
I235 A TLC27M21
C241 1n5
R241 10k
I235 B TLC27M21
BC849C Q250
BD158 Q251
4k7 R250
1/2W
68R R251
100k R253
1u C254
120k R254
VCC
10k R262
100k R265
ONHOOK
BC849C Q265
4k7 R263
68n C263
10n C267
100k R281
100k R282
1u C282
Product MAX
Module no 000402
Pcb no P00003
Title Teleadapter
File AUDIO
Benefon Oy
Date 1-Sep-92
Designer
Sheet 2 of 3


VCC
D303
BAT74
R303
4k7
VH01
VR01
GND
MIC
AGND
AUTOC
EXAL
TXD
I2CINT
SDAH
9V
ERPH
RXFIX
PTT
RXD
SCL
TXAUDIO
A315 C
A315 B
Q317
IRFS1Z3
R317
10k
JUMP
RXCOINBOX
RXFIX
RXAUDIO
R315
0R
A315 A
RA9W-K
D315
BAV70
R306
10k
BC849C
Q306
R305
10k
R311
4k7
Q311
IN_USE
CTA_HOOK
TEL_LINE
VT01
C321
68n
L321
10u
E
Q370
BC849C
Q371
BC859C
C373
47n
D373
BAV99
C375
47n
C376
47n
L357
1u
C355
330u
C356
330u
C357
330u
Q323
IRFR9210
R323
10k
D328
BYV26B
C328
22u
C329
22u
L331
BST40
Q325
R325
4k7
BST40
Q326
R326
10k
Q335
IRFR024
R333
15R
C333
10n
R335
10k
R336
56R
I341
UC2843
OUT
Vcc
Isense
Vref
Vfb
Rt/Ct
COMP
GND
C378
47n
R339
1k
R338
0R22
1/2W
C339
470p
R371
100R
1/2W
R351
R352
6k8
C352
1n5
C353
47n
R342
330k
R345
100k
C345
100p
R343
10k
RING
R347
33k
RING_GATE
R365
220k
R362
100k
I205
33182
D361
BAV70
D367
BAV70
R368
4k7
4V5
Product MAX
Module no 000402
Pcb no P00003
Title Teleadapter
File SMPS
Benefon Oy
Date 1-Sep-92
Designer
Sheet 3 of 3

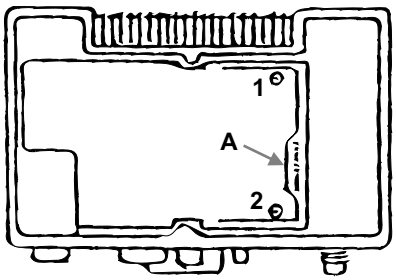
13.0 INSTALLATION OF ANSWERING MACHINE

The answering machine is installed inside the transceiver unit.

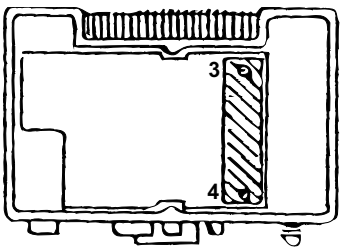
Place the transceiver unit on the table, the cooling plate away from yourself, so that the antenna connector is on its right side and the power connector on its left side, figure 1.



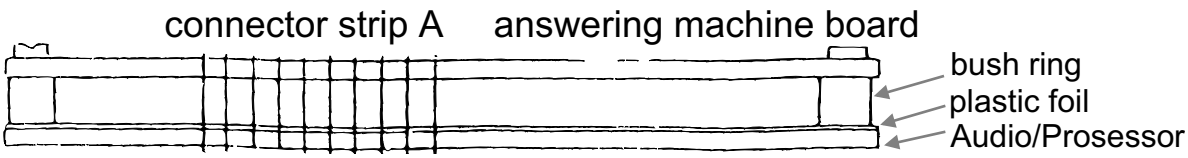
Unscrew the head bolts, and remove the cover. Now you can see thr Audio/Processor voard and on its right side the connector-strip A, to which the answering machine is connected, figure 2.



Release screws 1 and 2, and place the Audio/Processor plastic foil peaks into the corresponding holes in connector-strip A. Fasten the unit with screws 3 and 4.



Check that all connector peaks are in their holes, and when you are sure that everything is in order, close the cover and test the machine.



connector-strip Aanswering machine board

13.1 Answering Machine

13.1.1 Processor

The central processing unit for the answering machine is Intel 80C31. The processor

- reads the PROM program memory
- stores the speech, digitized with the delta-modulator, in DRAM memory, and tran stored speech from RAM to the delta-modulator,
- refreshes DRAM circuits
- communicates via the I2c bus with other devices connected to the system,
- controls the audio signal path control switches,
- controls the ringing tone signal,
- generates the "watchdog" reset pulse.

13.1.2 Memory Control

The processor may uses the program memory D190 and the dynamic RAM D200-D220.

The memory addressing timing functions are assisted by control logic. The processor refreshes the dynamic RAM circuits at 8 ms intervals.

13.1.3 Watchdog

D110C resonates at a frequency of approx 3 kHz, independent of the processor. This logic-level pulse is led to the counter D260. The watchdog reset pulse of the processor zeroes this counter at 8 ms intervals. There is no reset pulse when the program malfuctions. In that case the counter is free to proceed so that the counter D260A MSB will reset the processor.

13.1.4 Audio Paths

The answering machine recognizes the audio signals coming from TXAIN- and RXAIN-lines. It transmits an audio signal to TXAOUT- and RXAOUT- lines.

N230A ampflies the incoming audio signals. N240B is a compressor which drops the incoming audio signal dynamics to an appropriate level for the delta modulator. N170 is a delta modulator which converts the incoming audio signal to serial data. When repeating the stored speech, N170 converts the serial data coming from the memoriesn to an analog signal, which is led to the buffer amplifier N230d. The signal goes forward to the expander N240C, which then expands the comperssed speech dynamics to the original level. The compressor is followed by an active low-pass filter on which the processor-generated ringing-tone signal is combined. The last unit is the buffer amplifier N230C. The signal coming from N230C is led to either

RXAOUT- or TXAOUT-line with CMOS- switches N250C and N250D.

13.1.5 ICC-Operation

Communication between the radio unit and the answering machine is accomplished with an IIC-bus (lines SDA, IICINT, and IICENA). When necessary, the radio unit can disconnect the SCL-line with N140D. There is an open-collector output (V291) on the IICINT-line; the up-draught resistor is at the radio unit.

13.1.6 Operating Voltages

The answering machine gets its operating voltage from the radio unit (X290).

The operating voltage range of the answering machine is 10.6 - 16 V dc. In stand-by, the current consumption is approx 20 mA; when recording and repeating speech, it is approx

90 mA.

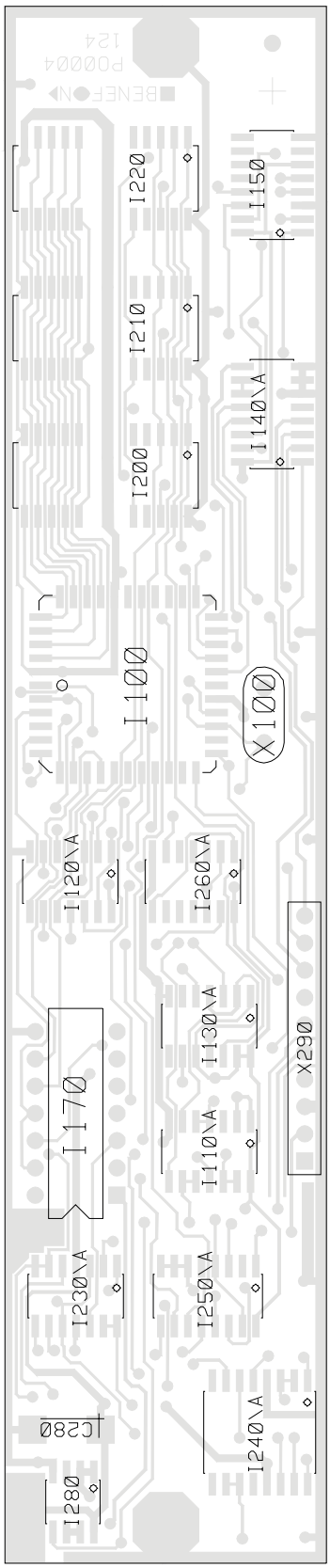
13.1.7 Parts list

CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
CD0220	C101	SMD capasitor	22 pF 5% 50 V NP0	Philips	
CD0220	C102	SMD capasitor	22 pF 5% 50 V NP0	Philips	
CC0473	C111	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0102	C112	SMD capasitor	1 nF 5 % NP0	Philips	
CC0473	C140	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CC0473	C171	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0223	C200	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CD0223	C210	SMD capasitor	22 nF 10% 50 V X7R	Philips	
CC0104	C220	SMD capasitor	100 nF 10% 50V X7R	Philips	
CC0473	C230	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0562	C231	SMD capasitor	5.6 nF 10% 50V	Philips	
CD0562	C232	SMD capasitor	5.6 nF 10% 50V	Philips	
CD0222	C233	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CC0473	C234	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0222	C235	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CD0222	C236	SMD capasitor	2.2 nF 5% 50 V NP0	Philips	
CD0562	C237	SMD capasitor	5.6 nF 10% 50V	Philips	
CC0473	C238	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CD0102	C239	SMD capasitor	1 nF 5 % NP0	Philips	
CC0473	C240	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CU0105	C241	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CU0105	C242	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CU0105	C243	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0104	C244	SMD capasitor	100 nF 10% 50V X7R	Philips	
CC0473	C245	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CU0105	C246	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CU0105	C247	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CU0105	C248	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0473	C250	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CU0106	C280	SMD tantal	10uF/16V 20% 6x3.2mm	Matsushita	ECST1CC 106R
CU0105	C281	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
CC0473	C282	SMD capasitor	47 nF 10% 50 V X7R	Philips	
CU0105	C283	SMD tantal	1uF/16V 20% 3.2x1.6mm	Matsushita	ECST1CY 105R
DS0099	D100	SMD diode	70 V 200 mA	Philips	BAV 99
DZ0919	D281	SMD zener	9V1 5% 300mW	Philips	BZX84-C9V1
DS0099	D290	SMD diode	70 V 200 mA	Philips	BAV 99
IP8052	I100	Prosessor (answ.mach.)	CMOS (maskprom)	MatraHarri	S80C52-xxx
IH0132	I110\	4x2 inp NAND schm.	HCMOS	RCA	74HC132
IH0032	I120\	4x2-inp OR	HCMOS	RCA	74HC32
IH0074	I130\	2xD-flip-flop	HCMOS	RCA	74HC74
IH4053	I140\	3x2-ch analog mpxer	HCMOS	RCA	74HC4053
IH0138	I150	3 to 8-line decod. inv.	HCMOS	RCA	74HC138
IX5564	I170	Deltamodulator		Harris	HC55564
IM1024	I200	DRAM	1MB x 1		TMS4C1024D
IM1024	I210	DRAM	1MB x 1		TMS4C1024D
IM1024	I220	DRAM	1MB x 1		TMS4C1024D
IA0324	I230\	4 x opamp			LM324
IA0571	I240\	Compandor		Philips	SA 571
IH4053	I250\	3x2-ch analog mpxer	HCMOS	RCA	74HC4053
IH0393	I260\	Dual 4bit bin counter	HCMOS		74HC393
IR2951	I280	Regulator	100mA 5V adj. 5%	National	LP2951CM
QS1054	Q280	SMD transistor	NPN 1.5A/45V	Philips	BCP 54
QSB848	Q291	SMD transistor	NPN 0.1A/30V F=2dB	Philips	BC 848 B
RD0103	R110	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0104	R111	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0103	R200	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0223	R230	SMD resistor	22 k 5% 0.125 W	Kamaya	

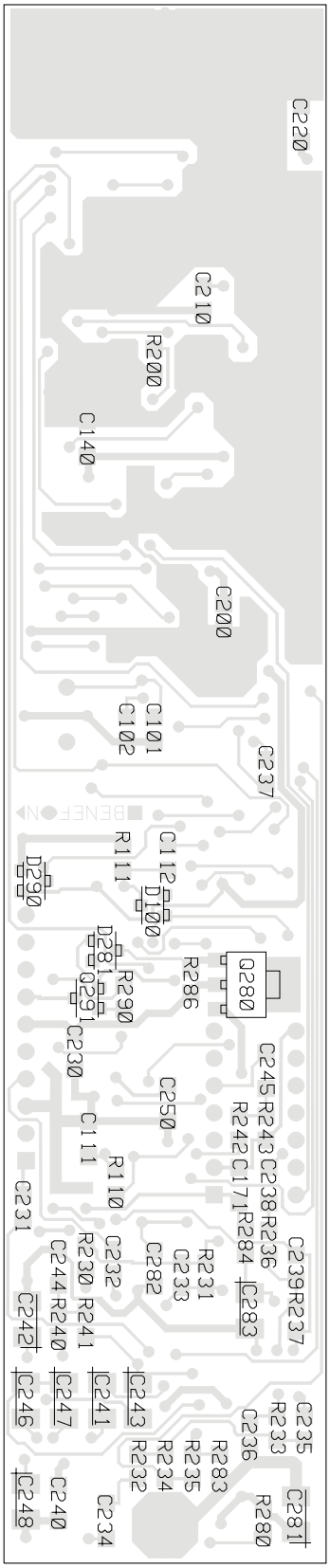
CODE	PART	DESCRIPT.	VALUE	MANUF.	TYPE
RD0223	R231	SMD resistor	22 k 5% 0.125 W	Kamaya	
RD0103	R232	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0103	R233	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0224	R234	SMD resistor	220 k 5% 0.125 W	Kamaya	
RD0104	R235	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0103	R236	SMD resistor	10 k 5% 0.125 W	Kamaya	
RD0104	R237	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0183	R240	SMD resistor	18 k 5% 0.125 W	Kamaya	
RD0183	R241	SMD resistor	18 k 5% 0.125 W	Kamaya	
RD0222	R242	SMD resistor	2.2 k 5% 0.125 W	Kamaya	
RD0332	R243	SMD resistor	3.3 k 5% 0.125 W	Kamaya	
RD0104	R280	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R283	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0104	R284	SMD resistor	100 k 5% 0.125 W	Kamaya	
RD0182	R286	SMD resistor	1.8 k 5% 0.125 W	Kamaya	
RD0473	R290	SMD resistor	47 k 5% 0.125 W	Kamaya	
X10247	X100	Crystal	10.245 MHz 30 ppm	Meiden	
VM0210	X290	Contact strip adapter	1 x10-pin	McKenzie	SST 1x10-880S

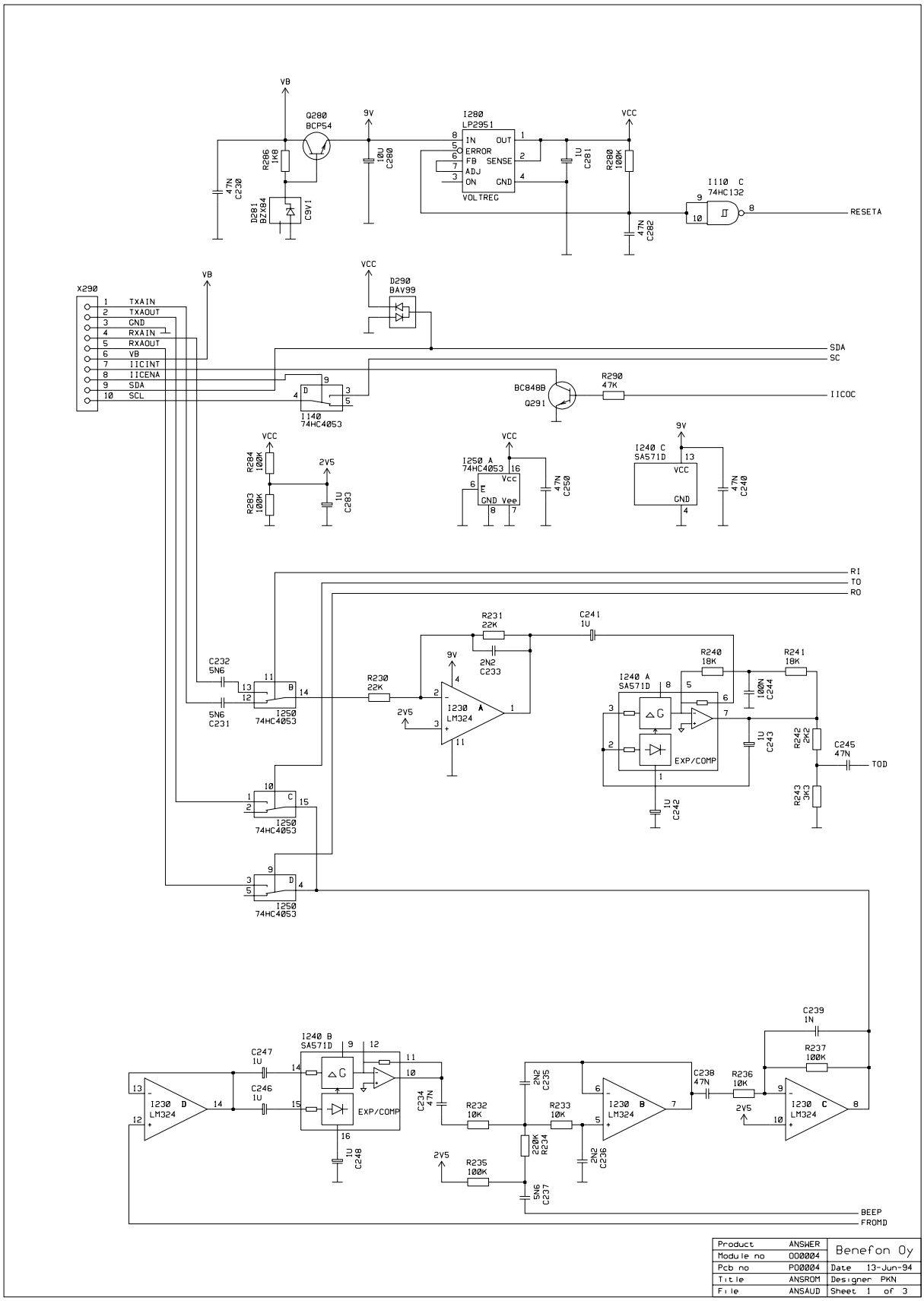
Last
update
10.04.92

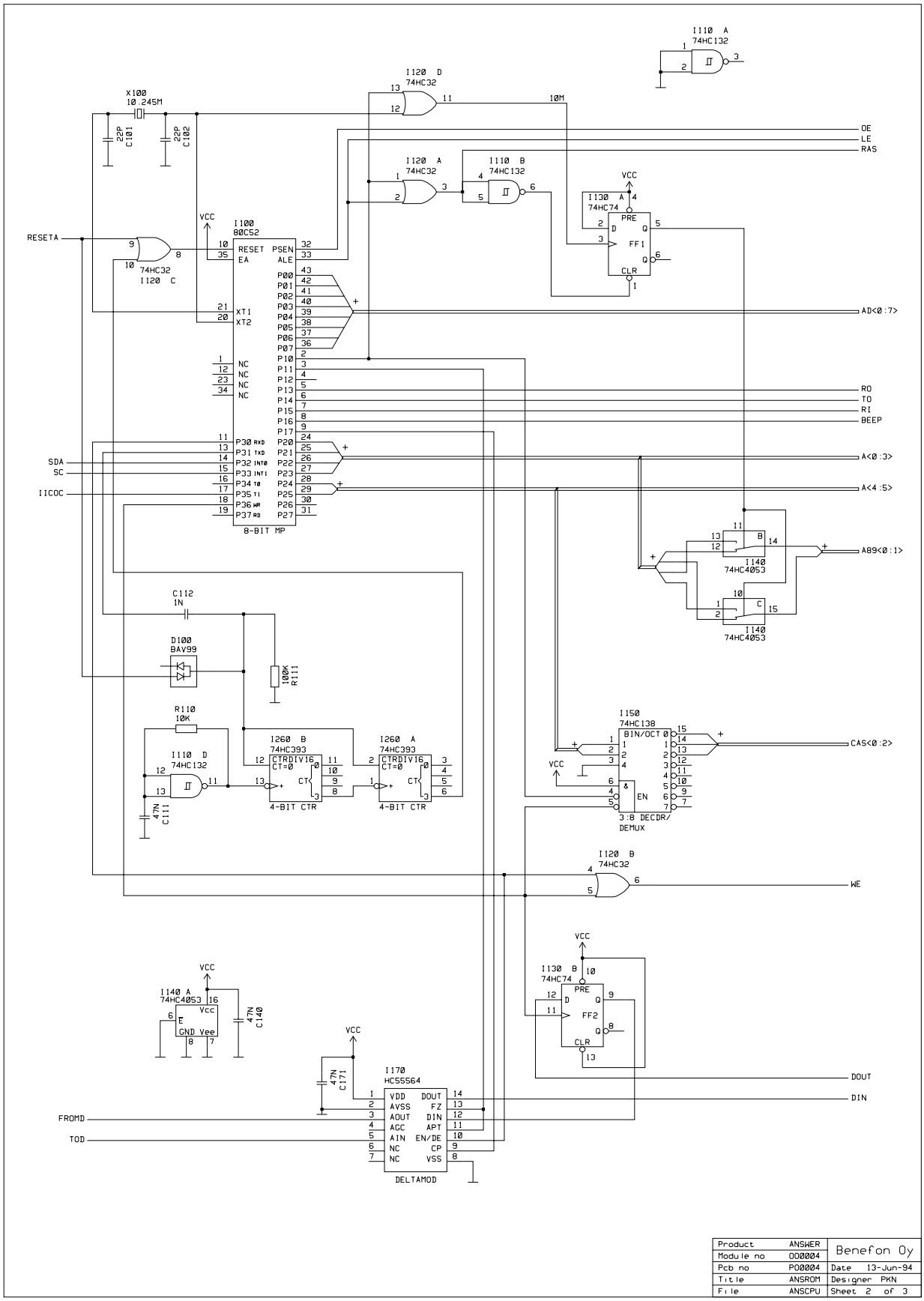
Component Side Layout

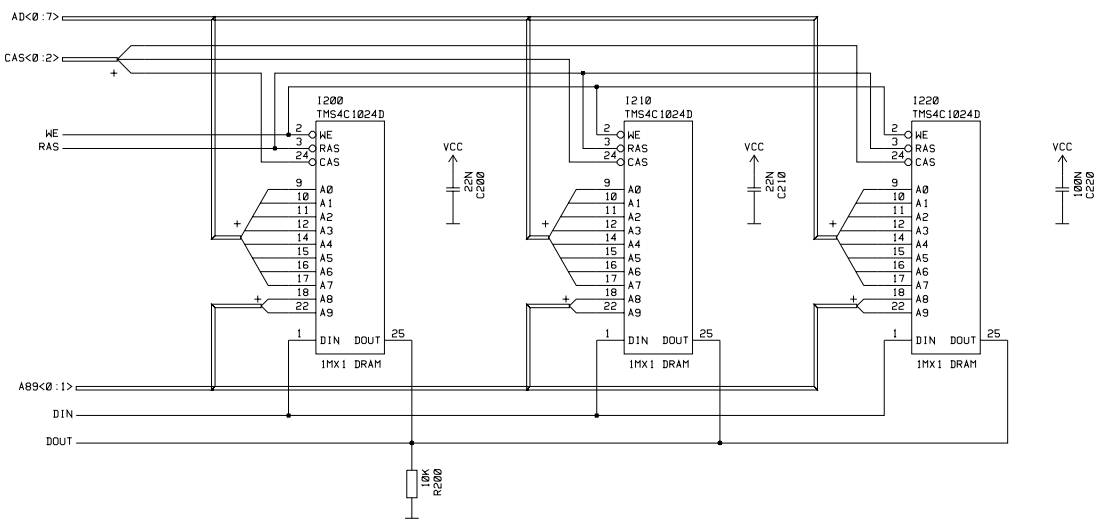


Solder Side Layout




VB
Q280
BCP54
9V
I280
LP2951
IN
OUT
ERROR
FB
SENSE
ADJ
ON
GND
VOLTREG
VCC
R286
1K8
C230
47N
D281
BZX84
C9V1
C280
10U
C281
1U
R280
100K
C282
47N
I110 C
74HC132
RESETA
X290
1 TXAIN
2 TXAOUT
3 GND
4 RXAIN
5 RXAOUT
6 VB
7 IICINT
8 IICENA
9 SDA
10 SCL
D290
BAV99
SDA
SC
IICOC
BC848B
Q291
R290
47K
I140
74HC4053
R284
100K
R283
100K
2V5
C283
1U
I250 A
74HC4053
Vcc
E
GND
Vee
C250
47N
I240 C
SA571D
VCC
GND
C240
47N
RI
TO
RO
R231
22K
C241
1U
C232
5N6
C231
5N6
I250
74HC4053
R230
22K
2N2
C233
I230 A
LM324
I240 A
SA571D
EXP/COMP
R240
18K
R241
18K
100N
C244
1U
C243
R242
2K2
C245
47N
TOD
R243
3K3
C242
1U
I240 B
SA571D
C247
1U
C246
1U
I230 D
LM324
C234
47N
R232
10K
2N2
C235
R233
10K
I230 B
LM324
C238
47N
R236
10K
C239
1N
R237
100K
I230 C
LM324
2V5
R235
100K
220K
R234
2N2
C236
5N6
C237
C248
1U
BEEP
FROMD
Product ANSWER
Module no 000004
Pcb no P00004
Title ANSROM
File ANSAUD
Benefon Oy
Date 13-Jun-94
Designer PKN
Sheet 1 of 3


I110 A
74HC132
I120 D
74HC32
X100
10.245M
22P
C101
22P
C102
10M
OE
LE
RAS
I120 A
74HC32
I110 B
74HC132
VCC
I130 A
74HC74
PRE
D
Q
FF1
CLR
RESETA
VCC
I100
80C52
74HC32
I120 C
RESET
EA
PSEN
ALE
XT1
XT2
NC
P00
P01
P02
P03
P04
P05
P06
P07
P10
P11
P12
P13
P14
P15
P16
P17
AD<0:7>
RQ
TQ
RI
BEEP
SDA
SC
IICOC
P30 RXD
P31 TXD
P32 INT0
P33 INT1
P34 T0
P35 T1
P36 WR
P37 RD
P20
P21
P22
P23
P24
P25
P26
P27
A<0:3>
A<4:5>
8-BIT MP
I140
74HC4053
A89<0:1>
C112
1N
D100
BAV99
100K
R111
R110
10K
I110 D
74HC132
47N
C111
I260 B
74HC393
I260 A
74HC393
CTRDIV16
CT=0
CT
4-BIT CTR
I150
74HC138
BIN/OCT
EN
3:8 DECDR/
DEMUX
CAS<0:2>
I120 B
74HC32
WE
I130 B
74HC74
FF2
I140 A
74HC4053
Vcc
GND
Vee
47N
C140
47N
C171
I170
HC55564
VDD
AVSS
AOUT
AGC
AIN
NC
DOUT
FZ
DIN
APT
EN/DE
CP
VSS
DELTAMOD
FROMD
TOD
DOUT
DIN
Product ANSWER
Module no 000004
Pcb no P00004
Title ANSROM
File ANSCPU
Benefon Oy
Date 13-Jun-94
Designer PKN
Sheet 2 of 3



Product	ANSWER	Benefon Oy
Module no	000004	
Pcb no	P00004	Date 13-Jun-94
Title	ANSROM	Designer PKN
File	ANSMEM	Sheet 3 of 3